The
Electrical Review

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The Newest Generating Station

THE new Fulham station commissioned last Saturday was the only one under construction, so we may expect no similar inauguration for another three years, when the projected Dartford station should be ready for service—a short time compared with that taken to get Fulham going.

There have been many reasons for the delay in the present instance which may bear directly or indirectly on the problem of providing new stations. The chief was opposition by public bodies to the erection in an urban area of a station at which over 2,000 tons of coal would ultimately be burned daily. The official inquiry (at the end of 1930) showed that many feared the possible effect of sulphur and grit emissions, but there is no reason to doubt that the plant installed (a later edition of the type at Tir John, Swansea) will be entirely efficacious in preventing trouble from either.

It is unlikely that the coal used will have as high a sulphur content as 1.5 per cent., and the margin allowed above that figure should be adequate, while maintenance of extraction efficiency should be ensured by the flue-gas sampling points pierced in the stacks. Another possible cause for objection has been resolved by recent studies in acoustics, which have resulted in minimising the noise from electrical plant.

After the consent of the Commissioners had been obtained, early in 1931, to the building of the station the site had to be cleared of houses and workshops. Even then it was not until 1934 that the Council had been able to acquire enough land for the storage of nearly a month's reserve of coal, a necessary adjunct to a base-load station.

The choice of the Fulham site provides an outstanding example of how great a distance has been travelled beyond the old parochial ideas relating to the production of electricity. The m.d. on the undertaking is less than 15,000 kW and, of itself, would not, of course, have justified the building of so large a station. However, the site is an excellent one for economical generation and is well placed to serve the needs of London as a whole, and most of the output will be exported to the grid. Local benefit should, at the same time, be appreciable. Indeed, we have heard of terms quoted, on the strength of legitimately anticipated results, for loads that would not otherwise have been secured.

Yet in spite of all the refinements introduced, one of which is the automatic regulation of temperature of superheated steam, a notably better technical performance need not be looked for than those put up recently by Battersea and Barking, which operate under similar steam conditions. The overall economy of boiler pressures of 650 lb. per sq. in. is now generally regarded as most suitable to the circumstances of public electricity supply in this country.

Departure from this standard is a matter for local initiative, and the precedent set at Bradford, on a relatively small scale, of using 1,100 lb., has not been followed. It remains to be seen whether the results achieved at Brimsdown A with higher pressures and with forced-circulation units will mark a turning-point in power-station practice.

Defence Contracts

MR. D. A. BREMNER, Director of the British Engineers' Association, has written an instructive statement which might profitably be read by all concerns, engineering and otherwise, who are, or may be, carrying out contracts under the national defence programme which are due to be completed by March, 1939. It appears in the current number of the *Bulletin* of that organisation. The writer examines briefly various provisions included in the general conditions of contract used by the Admiralty, the War Office and the

Air Ministry, and, recalling some of the disastrous experiences of manufacturers after the Great War, proceeds to deal with some of the arrangements affecting contracts placed under the present scheme. He discusses certain risks that are inevitably involved in spite of the good intentions of the Government. The points covered include capital expenditure upon works extensions and equipment; the responsibility of the contractors for these when partly financed by the State; problems inseparable from the mixing of defence contracts with general production orders; and clauses affecting price variations due to changes in wage rates and in cost of materials. The responsibility for the maintenance of buildings and plant in a state of productive efficiency at the end of the stated contract date, for a definite period of years, receives attention, while Mr. Bremner also mentions certain situations which would arise from the cancellation of contracts or part thereof for political reasons or to prevent production in excess of the national needs in certain eventualities which cannot be predicted. We can but generally indicate the ground covered; there are many other matters, such as the computation of profits, which naturally are of great importance to private industry. The author seems to have in mind, more particularly, the case of the engineering firm which is new to Government contract work, but he assures such that it can rely upon receiving fair and reasonable treatment, though the publication of the statement proves his conviction that everybody undertaking such work should take due precautions.

Fire Prevention

The consequences of a fire in a generating station or a large substation have become much more serious in recent years, but the putting into effect of the preliminary recommendations of the Electricity Commissioners' Committee (Electrical Review, August 21st) ought materially to reduce the chance of an outbreak and also—what may be of even greater importance—the risk of a fire spreading to sound plant. Those concerned will, however, realise that while the possibilities of a fire may be great, it is probabilities that they are dealing with. There are many factors that have to be taken into account, especially in the older stations, and the deduction that may be drawn from Mr. W. Kidd's article this week is that the maintenance of a reasonable perspective is necessary in order to avoid anything like a stampede in the direction of actions that are not justified by the circumstances obtaining in each case.

Good News from Argentina

Mr. H. C. Siddeley continues to use his influence and experience in Argentina for cultivating friendly relations between British and Argentine engineers. As readers may remember, he was elected some months ago a member of the Centro Argentino de Ingenieros, which is a sort of combination of the Institution of Civil Engineers and the St. Stephen's Club at Westminster. Membership was limited, until recently, to Argentine engineers who had taken their engineering diploma at an Argentine university; but its constitution has been altered to admit a certain number of foreign engineers and Mr. Siddeley was in the first batch of elections. He has just taken advantage of an opportunity afforded him as the only representative of both the Argentine and the British institutions of organising a "camaraderie luncheon." This took place on August 29th, when the British Ambassador, Sir Neville M. Henderson, who is keenly interested in the movement, was present. The function, which was a complete success, is to be followed by fraternisation of the Argentine and British engineers at their respective institutional meetings. It is pleasing to hear that the business outlook in Argentina is quite hopeful, and it is reasonably expected that the closer relationship that Mr. Siddeley is seeking to bring about will be for the mutual benefit of both countries. An indication of the electrical trend is found in the fact that for the first six months of 1936 the value of electrical imports increased by about £120,000.

Highway Lighting

Purley Way provides an excellent demonstration ground for a public lighting installation. As the Croydon by-pass it carries a heavy traffic to and from the coast and the outer suburbs of London, so that motorists in mass can assess for themselves the value of good illumination in making fast night driving safe without headlamps. Its proximity to the airport enables the increasing number of people who travel by air to gain an impression of the high visibility obtainable with a glare-free uniform system of modern public lighting, and a view from this aspect can be commended to all interested in road safety. The four miles of sodium lighting installed by Mr. F. N. Rendell Baker, borough electrical engineer, Croydon, should certainly stimulate public interest in main-road lighting. The scheme is somewhat similar to that which the Belgian Government has decided to employ along the entire length of the road between Brussels and Antwerp. Compared with the pioneer mile of sodium lamps which was started up outside the aerodrome nearly four years ago, the electrical features show a considerable advance and the present lamps run direct off the Corporation's a.c. mains.

SPECIAL DOMESTIC NUMBER

Next week's issue of

THE ELECTRICAL REVIEW

is our annual Domestic Number. In addition to specially contributed articles, the progress and trend in the principal uses of electricity in the home will be surveyed.

The Small Undertakings

As we have already stated, there is naturally a great deal of perturbation among the smaller electricity supply undertakings regarding the McGowan Committee's proposal that those with outputs below ten million kWh per annum shall be absorbed by larger undertakings. Some of the engineers of these smaller concerns have written to us to emphasise that size is no criterion of efficiency. Some of them can give their consumers electricity at very low prices, which, provided reliability is assured, is the most important consideration of all. These, at least, have a case which should be heard and this case will be put forward at a conference of small undertakings, to be held in London on October 23rd. The meeting is the result of efforts made by Mr. A. J. C. de Renzi, borough electrical engineer of Newcastle-under-Lyme.

To the Fortunate

The electrical industry is often deemed to be the most prosperous of all. Whether it is or not it cannot be doubted that it continues to flourish in spite of depressions and alarms. This means that of the many thousands employed in the various branches of the industry a large proportion should be fairly well off. But there are many who through illness or advancing age have had to give up and they deserve the consideration of their more fortunate fellows. To the attention of the latter we recommend the article appearing on page 434 which tells them how they may render timely aid.

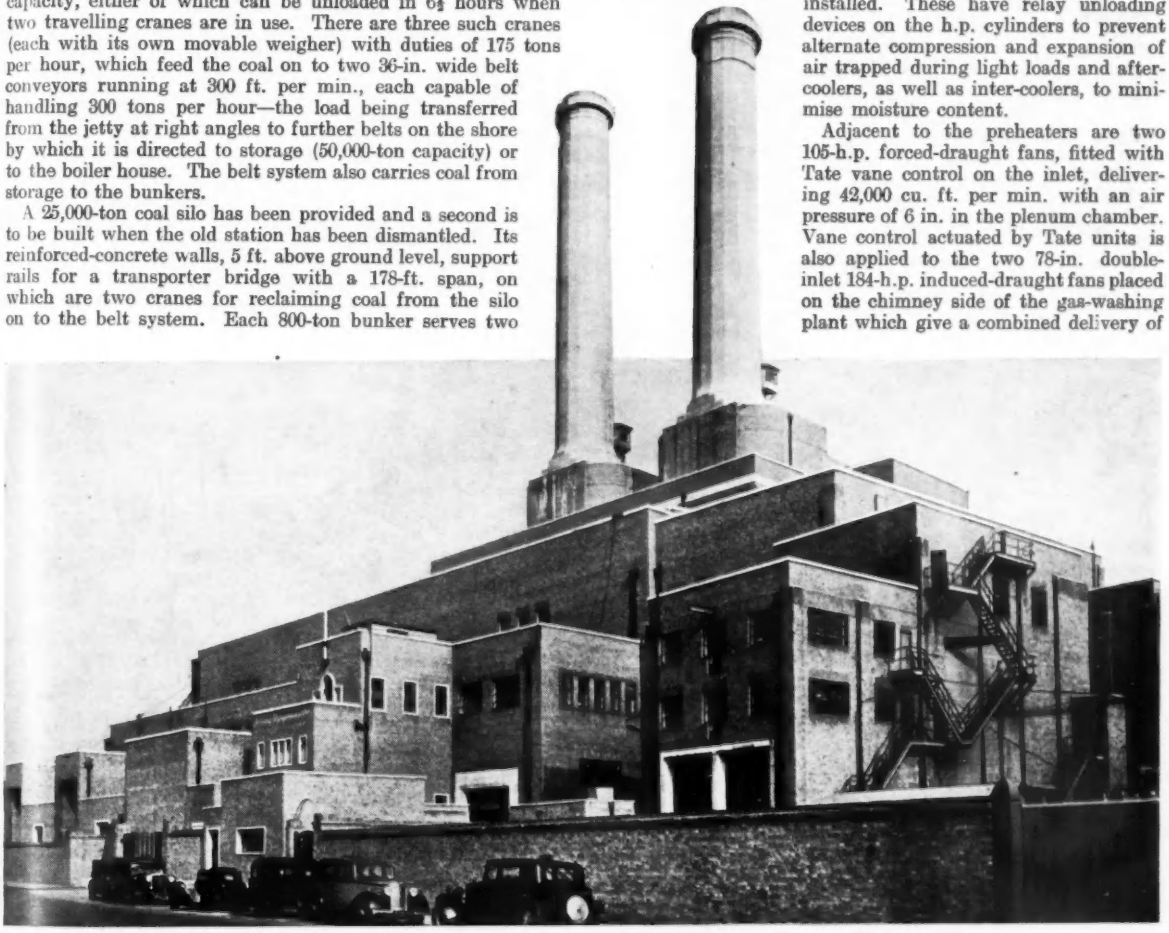
The Fulham Power Station

130,000 kW of plant— ultimate capacity 310,000 kW

THE first section of the new generating station of Fulham Corporation which was officially inaugurated on September 26th by the Mayor, Mr. S. Vanderhook, has a capacity of 130,000 kW, including provision for auxiliary plant. A third turbo-alternator now being erected will bring the installation to 190,000 kW, and later two more units will be put down, making the full capacity 310,000 kW—larger than that of any other municipally owned station in Great Britain.

Situated on a fifteen-acre site in Townmead Road, Fulham, adjacent to the Corporation's existing power station, the new station has a river frontage of 1,310 ft. A reinforced-concrete coaling jetty, 360 ft. long, is capable of berthing two of the undertaking's three sea-going colliers of 2,300 tons cargo capacity, either of which can be unloaded in 6¼ hours when two travelling cranes are in use. There are three such cranes (each with its own movable weigher) with duties of 175 tons per hour, which feed the coal on to two 36-in. wide belt conveyors running at 300 ft. per min., each capable of handling 300 tons per hour—the load being transferred from the jetty at right angles to further belts on the shore by which it is directed to storage (50,000-ton capacity) or to the boiler house. The belt system also carries coal from storage to the bunkers.

A 25,000-ton coal silo has been provided and a second is to be built when the old station has been dismantled. Its reinforced-concrete walls, 5 ft. above ground level, support rails for a transporter bridge with a 178-ft. span, on which are two cranes for reclaiming coal from the silo on to the belt system. Each 800-ton bunker serves two boilers through two sets of triple chutes, and any outbreak of fire would be coped with by a high-pressure water system.



In the boiler house (230 by 145 ft. in five levels) are six steam-raising units complete, with two others in course of erection. These are of the tri-drum type with individual normal evaporative ratings of 260,000 lb. per hour with steam conditions of 625 lb. per sq. in. and 850 deg. F.

The drums are forged out of solid steel ingots; the rear drum of each boiler has an internal diameter of 4 ft. 6 in., a wall thickness of 4⅜ in., and a length of 40 ft. 9 in.

Each of the stokers has a grate area of 708 sq. ft., and a width between side walls of 31 ft. 5½ in. It has eighteen retorts with separate speed operation on five sections, and is driven by oil pumps, by means of which the speed can be varied from zero up to 170 revs. per hour, without altering the speed of the driving motors, by a hand-wheel on the boiler control panel actuating a master oil valve.

Bailey furnace walls extending to the maximum height of the combustion chamber with an area of 1,460 sq. ft. represent 16 per cent. of the evaporative capacity. The total combustion volume per boiler is 13,500 cu. ft., and the total heating surface (including superheater and economisers) is 45,980 sq. ft. Maximum heat release per hour is 25,000 B.th.u. per cu. ft., and the fuel burning rate per sq. ft. of grate per hour 45 lb. Assuming a calorific value of 10,890 B.th.u. per lb., the hourly fuel consumption is 31,050 lb.

In the clinker pits (always full and holding 21 tons each) are crushing drums rotating at from 2 to 10 revs. per hour, which normally retain ash for ten hours before discharging it into a Hydrojet sluice system, by which it is carried to ash hoppers on the wharf.

Each unit is provided with a horizontal-tube economiser (14,200 sq. ft.) which raises the inlet feed-water temperature from 350 to 425 deg. F. Its ninety-six tubes, like those of the boilers, are coated with "Apexior" anti-corrosion compound. The gases after leaving the economiser enter two Ljungström rotary air preheaters (36,200 sq. ft. each), where they increase the temperature of the air from 60 to 400 deg. F.

For cleaning the preheaters, two air compressors (562 cu. ft. per min. at 300 lb. per sq. in. delivery pressure) have been installed. These have relay unloading devices on the h.p. cylinders to prevent alternate compression and expansion of air trapped during light loads and after-coolers, as well as inter-coolers, to minimise moisture content.

Adjacent to the preheaters are two 105-h.p. forced-draught fans, fitted with Tate vane control on the inlet, delivering 42,000 cu. ft. per min. with an air pressure of 6 in. in the plenum chamber. Vane control actuated by Tate units is also applied to the two 78-in. double-inlet 184-h.p. induced-draught fans placed on the chimney side of the gas-washing plant which give a combined delivery of 105,000 cu. ft. per min. at 124 deg. F. The (negative) water gauge at the suction is 12 in., and the (negative) pressure in the combustion chamber is ¼ in.

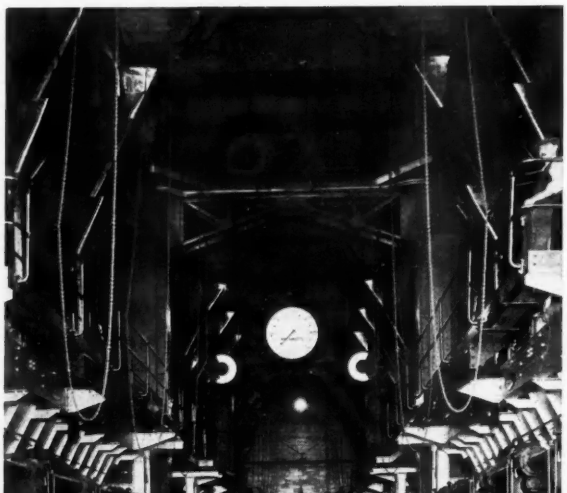
A notable feature of the steam-raising scheme is the employment of automatic temperature control with outputs above 120,000 lb. per hour. This is effected by means of a two-stage superheater with an inter-stage de-superheater, in which steam is cooled by passing through hair-pin tubes, the external surfaces of which are partly immersed in water taken from the boiler circulation. Heat thus given up by the steam is employed in raising steam on the water side. Alternative hand control is provided. The combined efficiency of boiler, superheater, economiser and air heater is expected to be 86 per cent. of the gross calorific value of the fuel as fired.

Another outstanding feature of the station is the sulphur extraction plant. One complete unit, divided into separate sections to facilitate cleaning, is attached to each boiler.

In this design the gases are scrubbed with lime or chalk liquor with which they are brought into intimate contact. The scrubber consists of wooden grids to a depth of 4 ft. over which the washing liquor falls by gravity from a head tank. None of the liquor is discharged into the river, but is recirculated at the rate of 13,000 gal. per hour per boiler, fresh lime being added as the Ca SO_3 or Ca SO_4 (found by combination with SO_2) is drawn off to settling tanks in which solids are removed and the clear liquor is returned to the system. A large excess of solid calcium sulphate is suspended

in the liquor, as deposits form on crystals in preference to the scrubbing surfaces.

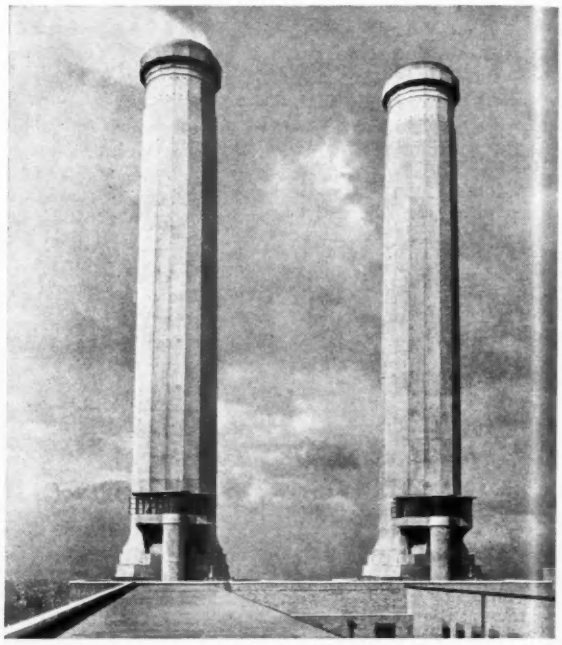
Each boiler equipment can deal with 105,000 cu. ft. of gas per min. at extraction efficiencies of 98 per cent. for grit and sulphur, the latter when the coal has a maximum sulphur content of 1.7 per cent. Entering and leaving temperatures of the gas are 240 and 124 deg. F., at which they are discharged into two reinforced concrete chimneys 300 ft. above ground level with an internal diameter of 21 ft. 6 in. at the base,



The firing floor of the boiler house

tapering to 17 ft. 6 in. at the top and pierced for five gas-sampling points.

There are seven electrically driven 1,480-r.p.m. feed pumps, of which four are fitted with hydraulic couplings. Four are driven by 250-h.p. motors and work with water at 220 deg. F. at the suction against 250 lb. per sq. in., and three at 365 deg. against 800 lb. On a fall in pressure in the feed system a steam-turbine pump, similar to the last named but with water at 200 deg. F., automatically comes into operation. The Metrovick motors operate at 6.6 kV and are so designed that there are no sudden changes in the air-filter area, thus obviating



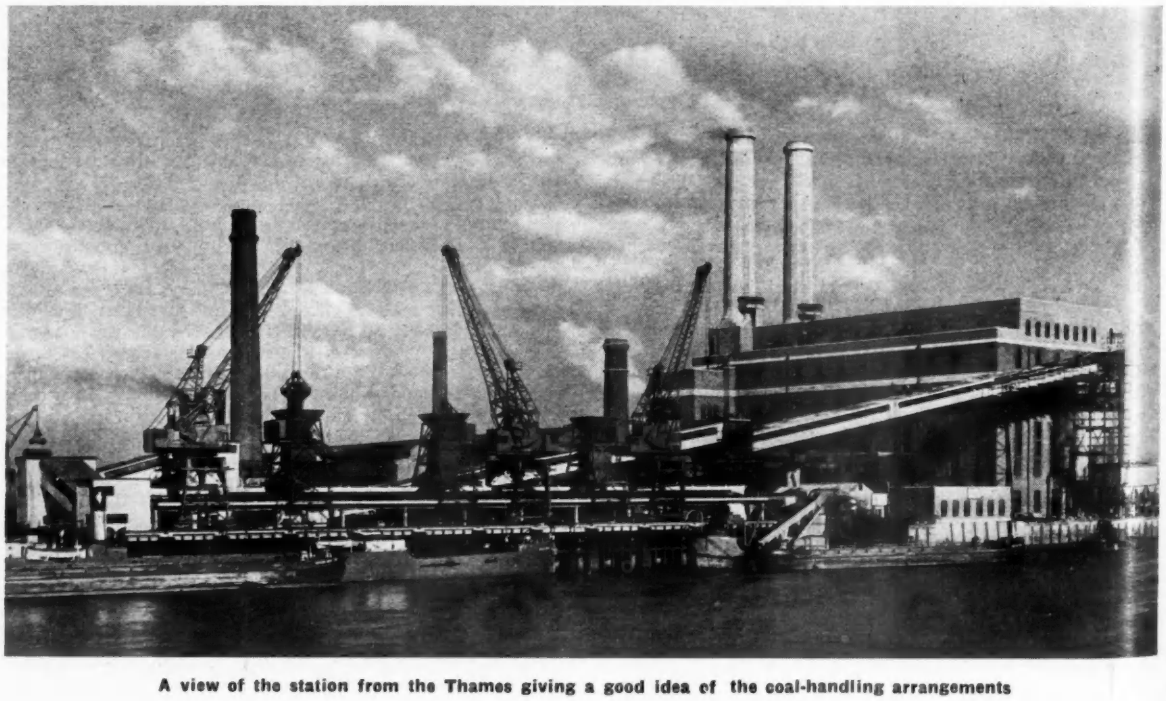
The chimneys, showing the flue-gas sampling points

a common source of windage noise. A number of electro-hydraulic thrustors are in use in which the rotation of a motor-driven impeller forces the oil from an upper to a lower chamber, thus exerting a steady thrust through the piston to operating rods.

An Electroflo control board has been installed for each boiler. On the vertical portion are carried gauges showing boiler-drum, superheater-outlet and economiser-inlet pressures, indicators for steam and water flow, and two eleven-point draught and pressure indicators for combustion-air control. Continuous indication is also given of superheated-steam temperature and of the CO_2 percentage and smoke density. A fourteen-point instrument measures the temperatures of water, gas and air throughout the boiler unit. From the lower vertical panels the stoker and fan dampers are controlled.

On the desk are the push-button switches controlling the induced- and forced-draught fans, secondary-air fans, washer recirculating pump and air preheaters. The complete panel is evenly illuminated by tubular lamps.

All recording and integrating instruments operating in series with the indicating instruments are located in the boiler-house control room, where a composite panel serves all the boilers and also control-panels adjacent to the turbo-alternat-



A view of the station from the Thames giving a good idea of the coal-handling arrangements

ors and the house set for recording their performances.

A 12-in. pipe connects each boiler to the top of one of three interconnected steam receivers in the feed-pump bay (six are to be installed) made from solid steel forgings.

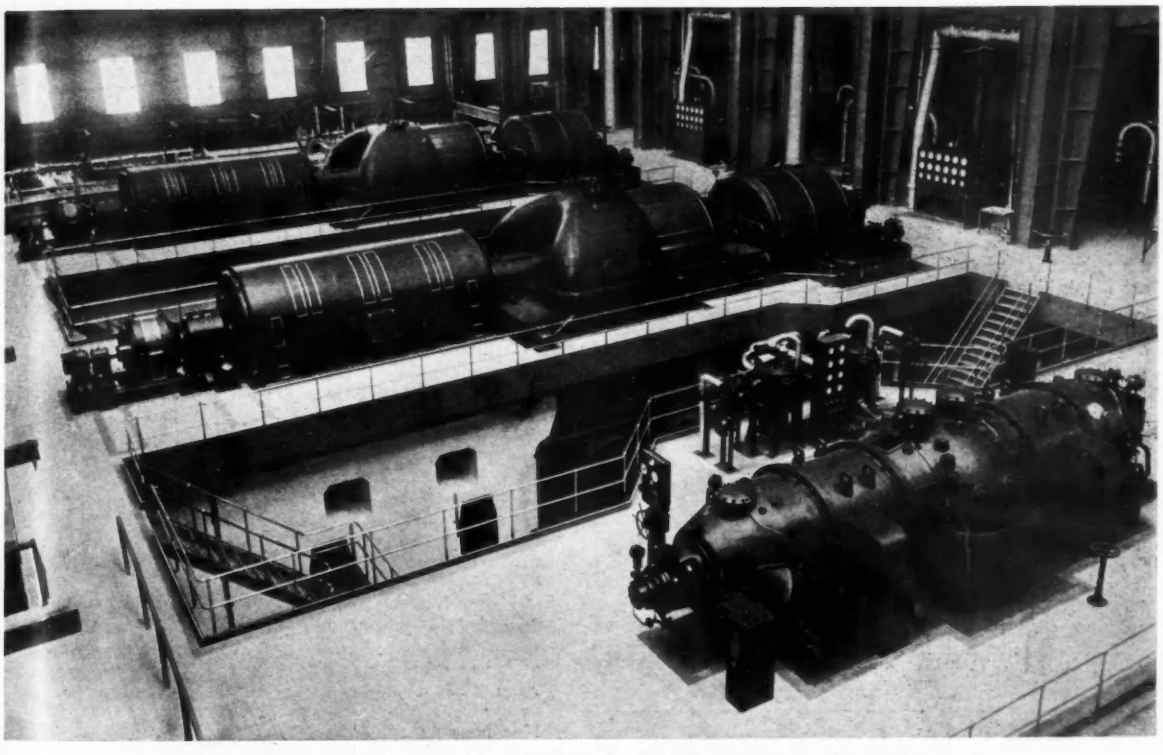
The two steam chests of each main turbine are connected by a 12-in. pipe to the underside of separate receivers through separators. The separator to which the auxiliary turbine and steam feed pump are connected is also supplied from two receivers. The pipes are of solid drawn steel with Corwel joints. The receivers (26 in. bore, 3 in. thick and 21 ft. long) and the separators are manufactured from forged steel bodies.

The two turbines now completed are of the two-cylinder impulse type, designed for steam conditions of 600 lb. per sq. in. and 800 deg. F., and run at 1,500 r.p.m., giving a top speed for the largest wheel of 810 ft. per sec. The h.p. cylinder has a velocity compounded stage followed by twenty-one single impulse stages and the low-pressure cylinder has thirteen impulse stages followed by a duplex multi exhaust. The diaphragms of the steel h.p. cylinders are built up, having molybdenum steel-plate centres and nozzles; stainless-steel blades are used and glands are of the radial-clearance comb type. In the low-pressure cylinder the diaphragms are of cast iron with cast-in steel blades (stainless-steel for the first seven wheels and special alloy for the rest except for the diaphragm of the final stage, which is of welded-steel plate.

temperature from 78 to 350 deg. F. At 60,000 kW the guaranteed heat consumption is 9.039 lb. per kWh generated.

The 11-kV, 50-cycle alternators are rated at 75,000 kVA (m.c.r.) at 0.8 p.f. Each rotor consists of a solid forging 53 in. in diameter, weighing 58 tons. The stator frame is of fabricated steel and weighs 91 tons. Concentric windings are employed with a sub-transient reactance of 17 per cent. The main exciter has a laminated field system energised from an overhung pilot exciter and its ceiling voltage is twice that of the normal operating voltage. Both exciters are totally enclosed and ventilated from the closed-air system, in which two fans on the alternator rotor and two 90-h.p. motor-driven fans circulate the air. Works tests at full output showed an alternator efficiency of 98 per cent.

The condenser with 54,000 sq. ft. of cooling surface is said to be the largest single shell constructed in this country. Each half is supplied with 22,000 gal. of circulating water per minute from a separate pipe system by means of two pumps delivering against a total head of 24 ft. at 485 r.p.m. and driven through horizontal shafts by 200-h.p. motors, the speed of which can be reduced by 40 per cent. during cold weather or light turbine loads. Three-stage Weir air pumps to provide a 29-in. vacuum (bar. 30 in.) at most economical rating, "Pervac" extraction pumps and starting ejectors, are provided in duplicate for each set.



The turbine room showing the two 60,000-kW sets with the 10,000-kW house set in the foreground

The operating arm of the governor actuates duplicate relay valves controlling two adjacent pistons, which are linked to relay valves, one on each steam chest. These control two horizontal power cylinders having extended shafts provided with cams, one for each steam valve. Relay valves mounted above the steam valves and actuated by the cams control oil admission to the power cylinders operating the steam admission valves.

For each turbine there are two groups of valves (each comprising an emergency stop valve and three steam admission valves) in parallel. The first valve pair admits steam to the first stage for loads up to 36,000 kW, the second pair after the stage for loads up to 48,000 kW, and the third pair after the fourth single-impulse stage. The safety governor of the ring type is in duplicate, tripping a valve to release the oil pressure in the power cylinders of the emergency stop valve and admission valves, causing them to close by spring action. A turbine-driven oil pump is provided for each unit for starting and emergency use.

The feed-heating system, which is out of the ordinary in that it includes de-aerating plant as one of the stages, comprises l.p., gland, de-aerating and three h.p. heaters, supplemented by ejector coolers. Two double-effect interstage evaporators fed with bled steam at 27 lb. per sq. in. for distilling town's water as feed make-up, also form part of the system. Steam is bled from the turbine at five points, increasing the condensate

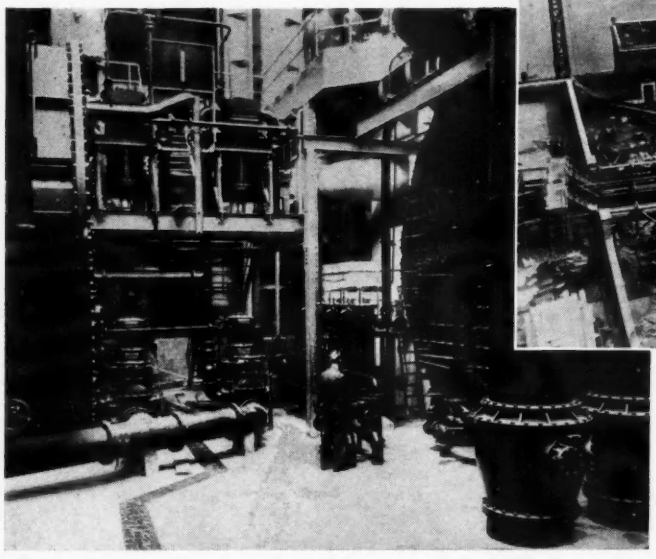
Switching is performed at 66-kV, each alternator being solidly connected to a 75,000-kVA three-phase delta-star transformer of the three-legged core type with concentric windings. Forced oil circulation and condenser-water cooling are employed. An oil conservator and gas-displacement protective relays are fitted to the tank. The total weight, including oil, but not the cooling equipment, is 106 tons. Each transformer is in a separate house and its cooling plant is in an adjoining independent chamber. The latter is in two sections (with a capacity of 600 gal. per min. of oil circulation and 150 gal. of water), either one of which can deal with the transformer losses at 60 per cent. of full load.

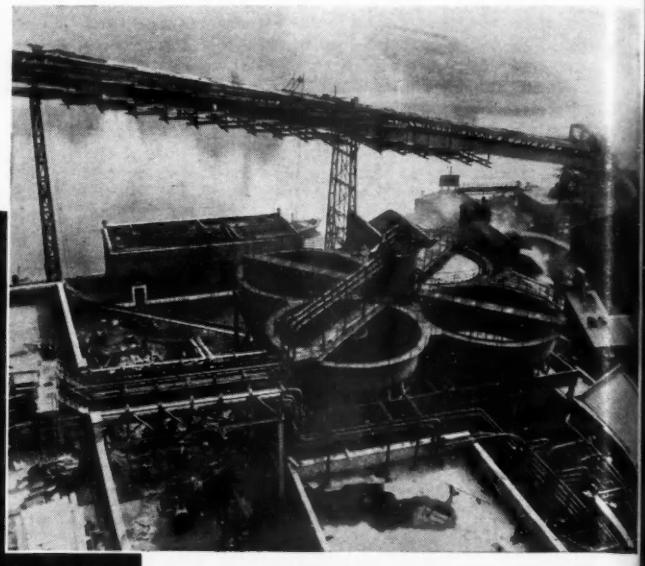
In a chamber alongside one of the main transformers is a 12,500-kVA, 66-kV/6.6-kV transformer, also of the OFW type, for providing auxiliary supplies. There are also two 1,000-kVA, and six 750-kVA three-phase units of the ON type, stepping down from 11 kV and 6.6 kV to 400 V. Eight 950-kVA, 6.3-kV/400-V transformers, air-blast cooled to minimise fire risk, for supplying the steam-raising auxiliaries are installed on an upper floor of the boiler house; each of these is fitted with a 2-h.p. fan delivering 3,250 cu. ft. of air per min., for dealing with the full load losses of the transformer (16.5 kW).

Auxiliary supplies can also be obtained from a house set, comprising a double-rotation turbine with 41 radial flow stages and two double-flow exhaust stages, driving two 5,000-kW, 6.6-kV alternators at 3,000 r.p.m. The blade rings of one turbine disc

are interleaved with those of the other. Two-stage bleeding is employed. The condenser is of the two-flow "Delas" type and obtains its circulating water by means of two pumps capable of delivering 11,200 gal. per min.; one is driven by an induction motor and the second (a stand-by) by a d.c. motor.

There are four separate switch houses, in three of which are contained the circuit-breakers for one alternator and four feeders in each case; the fourth includes the equipment for the transfer reactor circuit by means of which the alternators may be coupled together. The switch houses are divided by concrete floors into four compartments, *viz.*, circuit-breakers, busbars, tie-bar and cable.



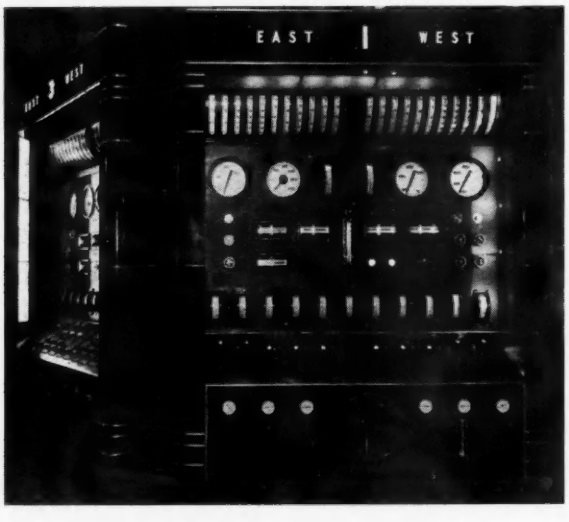


Above: Sludge tanks for sulphur elimination plant and part of the coal-handling gear. Left: Condenser pit with extraction pumps

Each alternator and feeder is controlled by two breakers, one connected to the section busbar and the other to a transfer busbar. The number installed at present is thirty-eight, all for remote electrical operation, with a rupturing capacity of 1.5 million kVA, and fitted with a cross-jet arc extinguishing device. No live portion of the circuit-breakers is exposed to the air; this is regarded as essential for 66-kV operation.

Busbars and other conductors are insulated by varnished paper condenser bushings protected by a layer of wire forming an earthed metal casing; this applies also to the 11-kV connections between alternator and transformer. A 20-ton crane is provided in each switch-house for isolating the breakers as well as facilitating maintenance work, the latter being carried out in the loading bay on an inspection stand whereon operating conditions can be simulated.

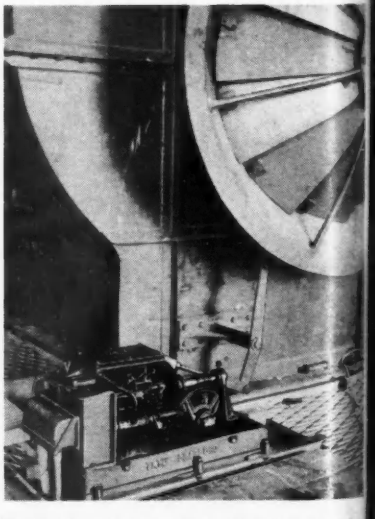
Each alternator with its mains and unit transformers is protected by a Merz-Price circulating-current system, and a restricted earth-leakage scheme is installed on both sides of the transformers. Each of the 11-kV systems is earthed through a voltage transformer operating an alarm, and a machine can continue to run on an earth fault until standby plant is brought into commission. The 66-kV, 75,000-kVA tie reactors (which are installed in brick cubicles outside the end of each section) in single-phase oil-immersed units are protected by a balanced earth-leakage system. They are connected to their switchgear through the wall of the switch-house, condenser bushings being employed, and the connectors entering the bottom of the reactor tanks. Balanced-voltage protective gear with standby over-current relays is used with the 66-kV feeders. In addition to the foregoing, all circuits are fitted with unrestricted earth leakage.



One of the four boiler-house control boards

Some 3,000 yd. of 66-kV single-core oil-filled cables have been run between the step-up transformer and the main switchgear, and from the latter to local and auxiliary transformers. Their cross-sectional area ranges from 0.1 sq. in. to 0.60 sq. in. Oil feeding pressure tanks are installed, in sets of three, adjacent to their cables in the switch-house basement.

Lead covered and armoured multi-core control cables are run in steel trays, instead of racks, and from the switch-houses to the basement of the control room (at the west of the turbine house) they are taken in a control-cable corridor which passes along the ends of the switch-house.

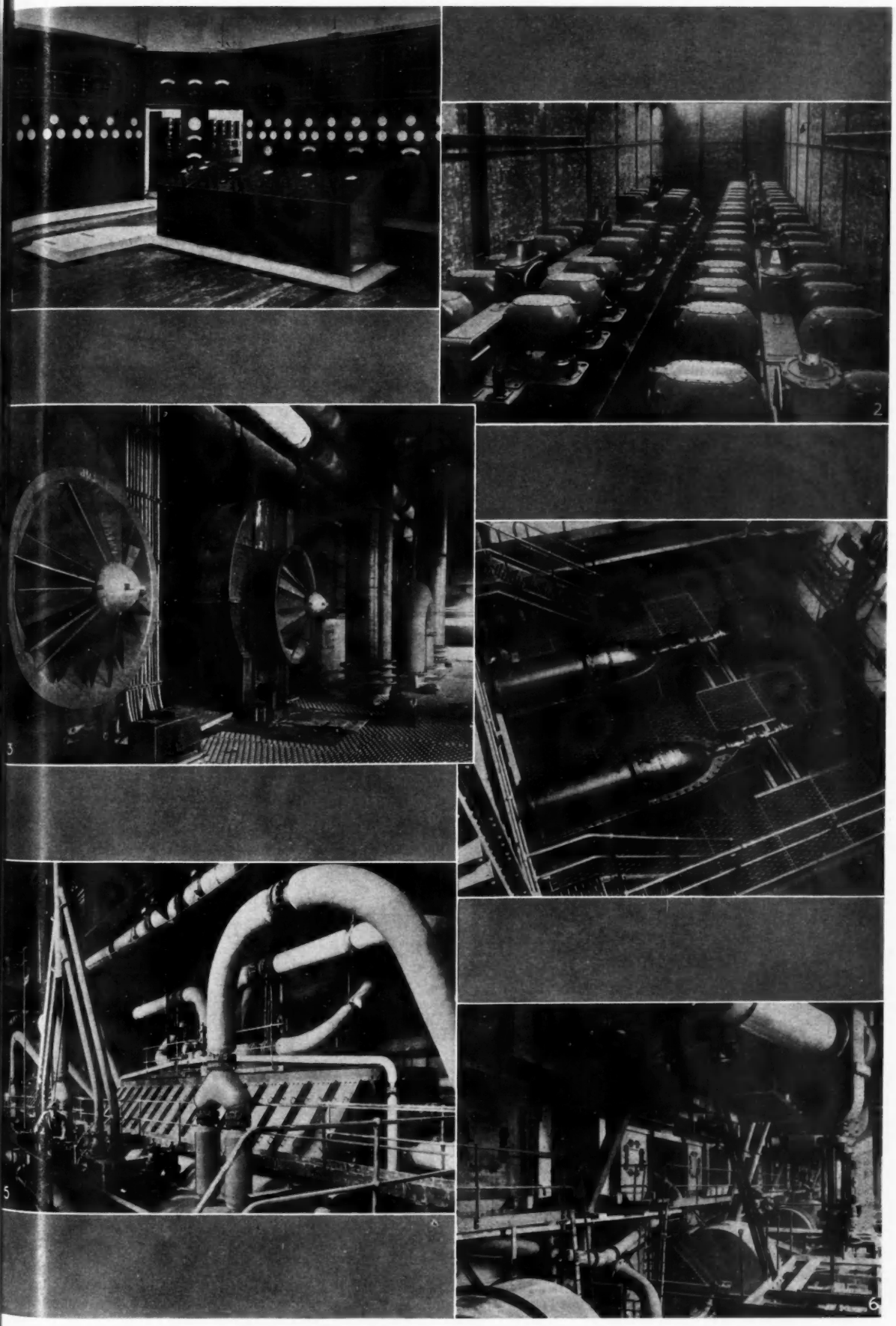


Mechanism of vane control for the forced draught fans

The walls of the control room are formed by the fronts of the cubicle panels, the tops of which meet the ceiling covering, and lighting (natural and artificial) is given through a glass ceiling suspended from the room. All instruments are back-of-panel mounted. Surmounting the panels is a mimic diagram with flush-type illuminated multi-coloured signals to denote the positions of circuit breakers and earthing switches.

The metal-clad 6.6-kV auxiliary switchgear is erected on an upper floor of the feed-pump bay. The breakers controlling the house alternator and transformers have rupturing capacities of 250,000 kVA, and reactors are fitted between these and the outgoing circuits, the breakers of which are designed for 100,000 kVA. At local distribution points the duty of the 400-V metal-clad switches is 25,000 kVA.

For fire fighting, a Pyrene system, employing CO_2, is installed in each main switch-house. A thermal device indicates the whereabouts of a fire to the control room attendant, who operates the switches that release the gas. Automatic and



Further Details of the Fulham Plant

1. The control room. 2. View of the 66-kV switchgear (raised). 3. Two of the forced draught fans. 4. Circulating pumps for the condenser of No. 1 turbo-alternator. 5. Steam connections at top of boiler. 6. Part of the sulphur extraction plant

An Appeal for E.I.B.A.

Bigger funds urgently needed

THOSE who have the interests of the Electrical Industries Benevolent Association nearest their hearts are convinced that the call for ambitious effort to be made to increase the funds is emphatically most urgent.

Things are going better than they were, thanks to more intensive organised effort from headquarters. Each year sees slight—but only slight—improvement, and we are confident that the year 1936-37 will produce something substantially better, but when one sits down seriously to the subject and concentrates upon it does it not seem almost appalling that this movement about which we have been writing in the ELECTRICAL REVIEW for the past thirty years, has distributed only £30,000 during that period and has helped only 400 necessitous persons? Of these sixty-three are receiving weekly grants, but the great bulk have had temporary grants to help them in times of heart-breaking distress. What pathetic stories could be told of relief coming in the nick of time!

The electrical industry is a great and remarkable one yet the charge has frequently been brought against it that its benevolent fund is smaller than those of most other industries. Let none think that the present electrical prosperity means a reduction of claims upon the Association's resources, for, during the thirty years that we have mentioned, thousands of men have grown too old to work.

Of the first generation of electrical men there are many to-day between sixty and seventy years of age who not only have been unable to make provision for the three-score years or three-score-years-and-ten period, but have been ineligible to share in any company pension or sectional benevolent scheme. The relief disbursed in 1936 amounts to 30 per cent. more than at this time last year, and the grants far exceed the interest on the invested funds. This does not seem altogether sound, but amid the clamour of insistent claims what is to be done?

The organisation has now, as its new Year Book shows, so large a company of councillors and committee-men that we are justified in listening for many new and original ideas for increasing the invested funds. One wonders what would be the outcome if all those whose names appear in the first ten pages were to justify their positions by thinking things out personally and determining that something magnificent should be accomplished within the next few months.

We are more or less acquainted with the self-sacrificing effort that a number of gentlemen have made during the thirty years to maintain the organisation and to attend to its enormous detail, and we give full credit to the Executive and to its Executive Officer, Mr. Seabrook, for working so energetically of late to awaken new interest.

The latest piece of information to reach us is very welcome. It is the decision of the General Electric Co., Ltd., which has done so much in so many ways to help the movement, to enclose an appeal for E.I.B.A. with every dividend warrant sent out. In this way the Newcastle Electric Supply Company succeeded in securing a very generous response from some of its shareholders, and we believe that the G.E.C. action will yield equally satisfactory results. A reminder to those who are receiving a share of profits earned by the electrical industry of the needs of many who have given their lives to building up that industry, is not presumptuous. We hope the course adopted by these two well-known companies will be followed by others.

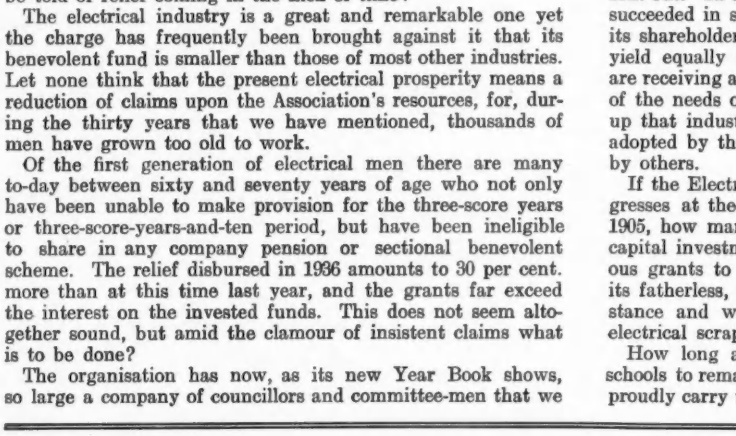
If the Electrical Industries Benevolent Association only progresses at the same pace as it has done since its birth in 1905, how many years will elapse before it has a substantial capital investment account, with ability to allow more generous grants to its sick in body and in mind, its widows and its fatherless, and the thousands of men whom hard circumstance and weight of years have thrown upon the human electrical scrapheap?

How long are electrical pensions funds, orphanages and schools to remain for some of us but a dream while other trades proudly carry them as an inseparable part of their existence?

Fulham Power Station (*Concluded from page 432*)

remote-controlled CO_2 equipment is also provided in the cable tunnel and in the transformer houses. "Mulsifyre" protection is given to the 6.6-kV switchgear and the turbine oil systems and store, while portable extinguishers are in use in other parts of the station.

The capital cost of the first 190,000 kW of plant is approximately £3,820,000, including the whole of the site and other works required for the complete station of 310,000 kW capacity.



The Fulham station as it will be eventually

The main contractors included: Aiton & Co., h.p. steam pipes; Sir Wm. Arrol & Co., Clyde Crane Co., Cowans, Sheldon & Co., cranes; British Thomson-Houston Co., battery and charging plant; Brush Electrical Engineering Co., auxiliary turbo-alternator and condensing plant; W. T. Henley's Telegraph Works Co., high-voltage cables; James Howden & Co. (Land), sulphur extraction plant, boiler-house auxiliaries, fans, air preheaters; International Combustion Co., ash-removal plant; Malcolm & Allan (London), auxiliary switchgear and power wiring; Mather & Platt, feed pumps, "Mulsifyre" fire protection; Metropolitan-Vickers Electrical Co., main turbo-alternators, main switchgear, transformers, motors; Mitchell Engineering Co., coal-conveying plant; Stirling Boiler Co., boilers; Vickers-Armstrongs, main condensing plant, pumps, and stoker devices; and Stewarts & Lloyds, Ltd., low-pressure pipework, &c. Among the principal sub-contractors were the Ash Co., Automatic Electric Co., F. W. Brackett & Co., British Vacuum Cleaner & Engineering Co., J. Browett Lindley (1931), Ltd., The Chloride Electrical Storage Co., The Dalyte Electric Co., The English Steel Corporation, James Gordon & Co., E. Green & Sons, Hopkinsons, Hydraulic Coupling & Engineering Co., Geo. Kent & Co., Lancashire Dynamo & Crypto, Laurence, Scott & Electromotors, Lea Recorder Co., Lee, Howl & Co., Newalls Insulating Co., A. Reyrolle & Co., Superheater Co., Taylor Stoker Co., Variable Speed Gear Co., Wm. Wadsworth & Sons, G. & J. Weir, Drysdale & Co., Ltd., J. Blakeborough & Sons, Glenfield & Kennedy, Ltd., Electroflo Meters Co., Ltd., and Tangyes, Ltd.

The borough electrical engineer is Mr. W. C. Parker, and the chief generation engineer Mr. H. Clarke. The joint consulting engineers were Messrs. Preece, Cardew & Rider and Mr. A. J. Fuller, by whom Dr. R. Lessing was retained in connection with the sulphur extraction plant.

All the photographs used to illustrate this article were taken by our staff photographer.

The Opening Ceremony

The assembly at the formal inauguration of the new station included many well-known men. Among them we observed Sir John Brooke, vice-chairman of the Electricity Commissioners, Sir Andrew Duncan, former chairman of the Central Electricity Board, Sir Felix Pole, Mr. J. H. Rider and Mr. A. J. Fuller (joint consulting engineers for the station), and Mr. A. C. Cramb (E.D.A.). There was a large crowd of local residents who thronged the turbine room and gallery.

The ceremony was performed by the Mayor of Fulham, Councillor S. Vanderhook, who was introduced by the chairman of the Electricity Committee, Alderman C. Lancaster. The speeches were relayed by means of B.T.H. public address equipment.

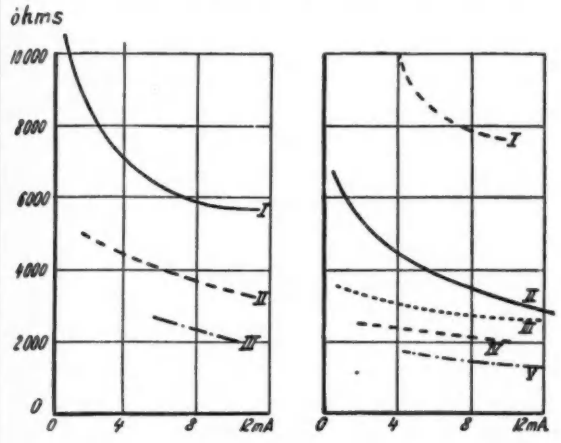
Prior to the starting-up ceremony the Mayor unveiled a tablet in the office corridor commemorating the skill and labour of those who built the station, including six men who lost their lives during its construction.

The original power station was constructed in 1901 with a plant capacity of 900 kW. In the year ended March 31st last, the plant installed amounted to 18,100 kW, the m.d. to 14,160 kW and kWh sold to 32.6 million. An agreement was made in August, 1929, between the Council and the Central Electricity Board regarding the "extension" of the station. This, in effect, meant the construction of an entirely new station to supersede the existing one, which is to be dismantled to provide an extension of coal storage accommodation.

Body Resistance. By T. C. Gilbert, A.M.I.E.E.

Variations with different persons and conditions

EXPERIMENTS carried out by the electricity supply authority in Zurich to ascertain what voltages could be regarded as safe in varying circumstances were described in the ELECTRICAL REVIEW of July 31st last, page 145. In these tests a.c. at 50 cycles was passed from hand to hand. The range of tests was then extended to current passage from foot to hand and foot to foot. The sensations experienced by the person under test were similar to those with hand-to-hand current, but the sensitivity was less as further resistances were added, consisting of shoes and socks, the resistances of which may be small or large compared with the body resistance. Para-rubber soles and dry socks of cork or straw offered complete insulation against the voltages in question.

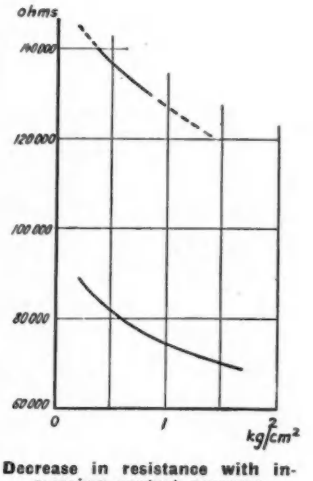


Left: I. Hand to hand, dry. II. Hand to hand, wet. III. Hand to hand, soda. Right: I. Foot to foot, wet shoes. II. Foot to foot, dry shoes. III. Wet shoes, dry hand. IV. Hand to hand, wet. V. Hand to hand, soda

According to the condition of the shoes, in respect of moisture or heavy nailing, total resistances are obtained foot-to-foot from 1,300 ohms to infinity; for the same reason the resistance varies foot-to-hand between 2,000 ohms and infinity.

In one case the person under test had a resistance to the right hand (6,000 ohms) double that to the left hand (3,000 ohms), probably due to his being right-handed with thicker skin on that hand.

For determining the dependence of resistance on the size of contact area, electrodes of different diameters were used, contact being made with the fingers. The contact area was ascertained by blackening the electrode previous to holding, and afterwards measuring the blackened area on the hand. As contact was never exactly alike there were slight differences, but the resistance for each person per sq. cm. could be obtained. Variations are due to the variable resistance of different parts of the body.



Decrease in resistance with increasing contact pressure

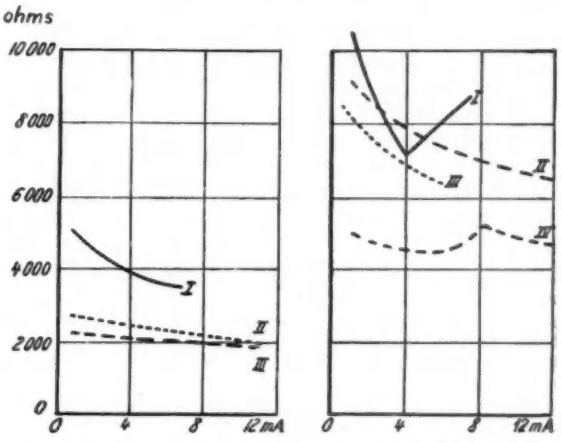
Apparently, with equal current density as well as condition of the skin the resistance may be taken as in inverse ratio to the contact surface. Assuming further that the measured body resistance hand-to-hand is composed of two equal resistances, which is mostly the case, it may be concluded that one cm² of skin has a resistance of about $30\times1500/2=22{,}500$ ohms up to about $30\times12{,}000/2=180{,}000$ ohms.

The resistance on contact may be estimated, in which the total resistance lies between $R=22{,}500/f_1+22{,}500/f_2=(f_2+f_1)\times 22{,}500/f_1\times f_2$, and $R=180{,}000/f_1+180{,}000/f_2=(f_2+f_1)\times 180{,}000/f_1\times f_2$, f_1 and f_2 being contact surfaces in sq. cm.

Accidents have occurred when pliers have been used, that is, pressure has been applied; this increases the contact surface, since the skin's inequalities are flattened out. A test made to discover whether it altered the skin resistance gave no basis for hard and fast rules.

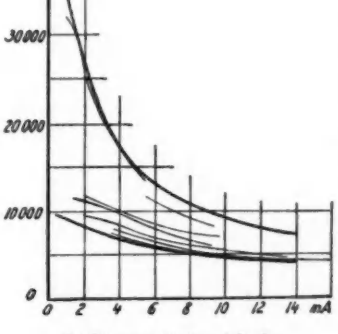
Sensations experienced with d.c. differ considerably from those with a.c. On grasping and releasing the electrodes a blow is felt, the total effect being concentrated at the contact points; the sensation is that of local heating, and it can only be withstood for a short period.

A current strength of 10 to 12 mA is very unpleasant, and must be regarded as the limit. Although the test conditions varied somewhat compared with those for a.c., yet the resistances agree in the main with the a.c. measured values, taking into account contact surfaces.



Left: I. Hand to hand, dry. II. Wet shoes, dry hand. III. Foot to foot, wet shoes. Right: I. Hand to hand, dry. II. Foot to foot, wet shoes. III. Wet shoes, dry right hand. IV. Wet shoes, dry left hand

For example, should a person have a resistance of 10,000 ohms with 16 cm² contact surface area, the current being 5.5 mA, then for the same current with 30 cm² contact surface the resistance would be $10{,}000\times16/30 = 5{,}330$ ohms.



Resistance tests with d.c.

Body resistance hand-to-hand or hand-to-foot is often 2,000 ohms, but under the less favourable circumstances visualised may be as low as 1,500 ohms.

With a current strength of 15 mA, release of the electrodes is difficult, if not impossible, so that the dangerous voltage for the most sensitive persons under unfavourable circumstances, and current flow hand-to-hand with dry hands would be $2{,}000\times0.015=30$ V, and with moist hands $1{,}500\times0.015=22.5$ V.

RESISTANCES WITH CURRENT FLOW HAND-TO-HAND; HANDS DRY. TESTS ON INDIVIDUALS WITH VARYING CONTACT SURFACE.

Electrode dia., mm.	Form of contact.	V.	mA.	Resistance, Ohms.	Contact surface, cm.²	Body resistance per cm.²	Skin res. per cm.²	Current per cm² surface.
9	Both hands, grip	35.0	8.0	4,375	18.0	78,700	39,350	0.445
9	,, ,,	42.0	9.0	4,670	18.0	84,000	42,000	0.500
20	Both hands, 3 finger-tips ...	44.0	3.0	14,700	5.5	80,800	40,400	0.545
20	Both hands, fist clenched ...	44.0	1.9	23,400	3.2	75,000	37,500	0.593
20	One hand and one finger ...	45.0	0.4	112,000	0.75	84,000	42,000	0.533
20	Both hands, grip	34.0	11.6	2,940	30.0	88,200	44,100	0.386
20	,, ,,	34.0	9.35	3,640	30.0	109,000	54,500	0.312
9	,, ,,	34.0	4.35	7,820	14.0	109,200	54,600	0.276
9	,, ,,	39.9	5.86	6,730	14.0	94,200	47,100	0.418
9	,, ,,	35.4	5.27	6,810	14.0	95,300	47,650	0.376
9	,, ,,	27.5	3.93	6,970	14.0	97,300	48,650	0.286

This applies only, however, under the assumption that the contact surface area is comparatively small, about 2×30 cm². A person seated in a bath is in considerably greater danger,

as taking 15,000 cm² (1.5 m²) as the wet portion of the body and 30 cm² for the hand which is in contact with the live circuit, a body resistance is obtained of R=22,500/15,000+22,500/30=1.5+750=752 ohms (approx.). The dangerous voltage in this case would be 752×0.015, that is, 11.3 V.

On the other hand, this reasoning cannot be applied to very small contact surfaces. For example, should 1 cm² of skin have a resistance of 30,000 ohms, then 1 mm² would have 3,000,000 ohms, and a person touching a 45,000-V line with a needle would accordingly only receive 45,000÷3,000,000, =0.015 A, which is a fallacy.

This shows that not only is the current strength important, but also the specific current; a current of 15 mA per mm² effects a physical and chemical change in the skin, causing a much higher conductivity. The tests were not, of course, carried out to the point where such changes occurred, usually noticed as burns, so that quantitative conclusions cannot be formed in this direction. Such conditions may be found possibly on test with dead bodies or animals; probably the limits are not specially high, and need not be sought in the high voltage ranges. Accidents which have occurred at 220 V, for example, have left so-called current markings, and these have shown that there was a physical change in the skin.

The Swiss authorities have further investigations in hand regarding the influence of the following factors:— Frequency in relation to resistance, fatigue, time of day (special case under (2)), food and drink (especially alcoholic), age (safety of children, *e.g.*, with electric toys), and wounds.

The range is so wide that tests will be difficult in all these directions, and details of accidents in practice would be a valuable addition. Only when the test results are completed by means of the addition of a large amount of further data can statistics be obtained for general use. A greater degree of clarity on this important question is, however, essential, as present regulations give an upper safe limit much higher than that indicated as safe in our tests. Revised regulations are therefore necessary for supply authorities in view of this variation.

The work done indicates the great complexity of the problem of defining safe voltage limits, and demonstrates that we are right in treating the sustained and the momentary contact voltage as falling into different categories.

Electricity at the Zoo

THE benefits of electricity in the service of man are being handed on to the lowlier orders of creation by the Royal Zoological Society to an ever-increasing degree. The illumination of certain parts of the Regent's Park Zoo on Wednesday and Thursday evenings in the summer is now an established and popular London feature, though perhaps this is conceived more from the viewpoint of the visitors than of the animals.

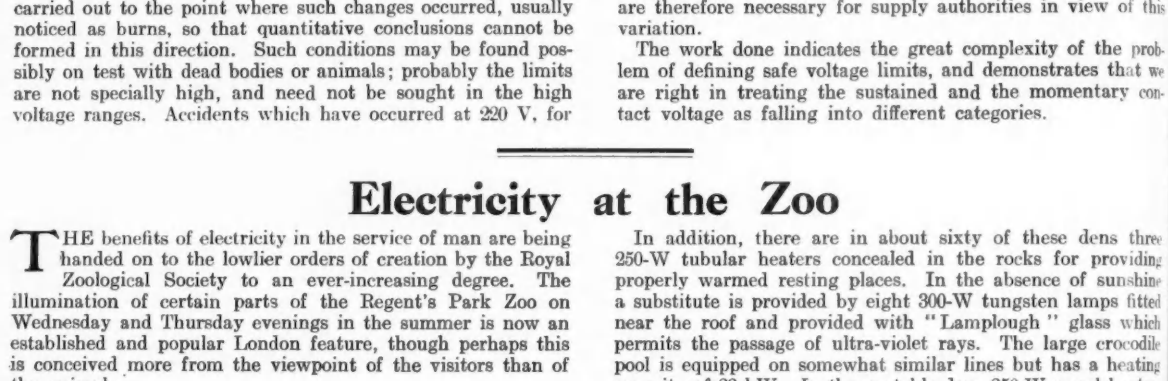
A good example of what is being done more obviously for the advantage of the inmates themselves is to be found in the arrangements made by Mr. H. P. Davolls, the Society's chief engineer, for warming the reptile house, where there are seventy-five large dens and twenty-seven small "portable" dens.

For maintaining the air temperature of the large type at from 75 to 80 deg. F., eight 1,000-W circular reflector heaters are fitted just above the front windows in each den; half of these are automatically switched on and off. The temperature of the water is kept at 70 deg. F. by eight 250-W thermostatically controlled low-temperature tray-heaters.

In addition, there are in about sixty of these dens three 250-W tubular heaters concealed in the rocks for providing properly warmed resting places. In the absence of sunshine a substitute is provided by eight 300-W tungsten lamps fitted near the roof and provided with "Lamplough" glass which permits the passage of ultra-violet rays. The large crocodile pool is equipped on somewhat similar lines but has a heating capacity of 23 kW. In the portable dens 250-W panel heaters with thermostats are installed.

Should the temperature in any den rise above a safe figure, a red light appears in the keeper's room; should it fall a green light shows. In either case a bell rings in the curator's office. The thermostats controlling the heating current are operated by d.c. at 40 V while the alarm circuits have a supply at 40 V a.c.

Electricity is used in the dens at 230 V a.c. transformed from the 6,600-V mains of the St. Marylebone Corporation, which has supplied to the Zoo for all purposes during the past twelve months 2,150,000 kWh, of which 942,000 kWh has been taken by the Reptile House.



Electric Lighting and Heating at the Zoo

1. An example of exterior illuminations. 2. The flamingo pool. 3. The Komodo dragon thrives in ultra-violet rays. 4. Distribution points and thermostats behind portable reptile dens. 5. Lighting and overhead heating equipment in the crocodile pool

Gramophone Motors.

By E. C. Wadlow, Ph.D., B.Sc.

Requirements that must be satisfied

SERIES-WOUND commutator motors, single-phase induction motors of various types and synchronous motors are used for driving gramophones. The motor is required to develop enough power to turn the record at 78 r.p.m. in such a way that its presence is unsuspected by the listener. It may fail to do this on account of: speed variation, noisy running, heating, and electrical and mechanical interference. Other factors entering into the question of suitability and satisfactory performance are convenient voltage and frequency operating range, reasonable first cost, convenient physical dimensions and reasonably long and trouble-free life.

Generally, the torque available at the turntable must be not less than about 400 gm. cm., measured at 78 r.p.m. This value is determined by the load imposed by the needle travelling round the record groove, and it is influenced by the following main points: Type of needle, material of record, wear of record and of needle, radius at which the needle is working on the record, nature of music recorded (*i.e.*, soft or loud passages), weight on the needle point, and pick-up characteristics.*

Speed Variation

The variation in speed which can be tolerated is determined by the sensitiveness of the ear to frequency changes. This varies considerably as between individuals, but for practical purposes it may be assumed that over its most sensitive frequency range the ear can detect a variation in pitch of about 0.3 per cent.† For notes of very low, and of very high, frequency, the permissible variation increases to about 1.0 per cent.

The constancy of speed necessary is obtained either by a mechanical speed-controlling device, or by using a constant-speed motor. A mechanical governor generally runs at about 1,100 r.p.m. If the motor runs at this speed, the governor is mounted directly on the armature spindle, but if it runs at turntable speed the governor is driven by gearing. The type of governor generally used is that in which three weights mounted on flat springs are arranged to move a disc along a shaft as the speed increases. The shaft and disc both revolve with the weights, and when full speed is reached the disc rubs against a fixed pad. Energy is dissipated here in friction, the amount being equal to the difference between that developed by the motor and that required to drive the record. Governors of this type can be readily constructed so that a change of torque (measured at 78 r.p.m.) of 500 gm. cm. will cause a change of motor speed of only one per cent., more than satisfying the requirements. Such governors are used with commutator motors and with induction motors.

Phonic and hysteresis motors are inherently constant speed types, the speed being determined solely by the supply frequency and require no external governor. Hysteresis motors are essentially high-speed machines, driving the turntable spindle through gearing. Phonic motors usually incorporate a flexibly mounted stator to give smooth running.

Heat Generation

The torque and speed necessary being settled by external conditions, the power input and the heat generated in the motor are dependent upon its efficiency. The efficiencies of all types of gramophone motors are low, the values ranging from 1.5 per cent. for certain induction motors to about 15 per cent. for some phonic motors. The power consumption will generally fall between 4 W and 40 W, most of which is converted into heat.

Heating can be objectionable in two ways. First, it may be localised, as in a coil, giving excessive temperature rise in the winding. The temperature rises allowable in the coils of these small motors are higher than in those of industrial motors, partly because they are generally used intermittently, and partly because the limit of 50 deg. C. observed in larger motors is conservative with small coils. Except in automatic gramophones, the motor is switched off at the end of playing each record, and even with automatic machines the motor will rarely run for longer than 45 min. without being switched off. The time taken for the temperature to reach its maximum value, even with continuous running, is at least two hours.

Enamelled copper wire is almost invariably employed for the coils. If scramble wound and bound with cotton tape before impregnating, a maximum rise of about 60 deg. C. is permissible (the temperature rise being determined by the resistance method after a continuous run of, say, three hours on maximum voltage). If the layers of wire are paper-interleaved and the coil impregnated, a temperature rise as high as 100 deg. C. under the above-mentioned conditions is permissible. These, however, are maximum figures. The rise on the more efficient motors is much less. On phonic motors, for example, it may be only 15 deg., and much below this on lower voltages.

The second way in which heating may become objectionable is by raising the general temperature of the cabinet and of the air in it. No damage is likely to be caused, but it may give a bad impression to the user. On account of this general temperature rise, the power input to the motor should not exceed 50 W, but all motors at present available have consumptions much below this value; if exceeded, it would be advisable to provide special ventilation.

Motor Noise

Motor noise becomes objectionable when it is audible above the reproduced speech or music, or rather above the surface noise of the plain cut portion separating two individual items on one record. The noises emanating from different types of motor vary considerably in character. Some are very penetrating, while some are easily masked. Most a.c. motors have a hum in which twice the supply frequency predominates, but in which third and higher harmonics are present. Owing to the greater sensitiveness of the ear to their frequencies, these comprise a greater proportion of the audible total than measurements of the harmonics in the current wave form suggest. This low-frequency hum cannot easily be masked by anything on the record, and must be reduced at the source.

High-speed squirrel-cage induction motors are characterised by a rotor slot whine, determined by the speed and number of rotor bars used. Usually the frequency is between 1,500 and 3,000 per sec., and the whine is thus more readily masked by music. Brush noise on high-speed commutator motors is made up of high-frequency vibrations, and is thus similar in character to record surface noise, by which it is easily masked. Motors with gears may give excessive noise, gear or bearing troubles often causing a variation in noise once per revolution. Those having a pulsating torque give more gear noise than when the torque is uniform.

To reduce the noise resulting from the transmission of audible frequency vibrators to the cabinet, the motor is usually insulated from the motor board by rubber washers. This scheme, however, is not wholly effective. The rigidity necessary to preserve turntable and brake clearances usually necessitates the mounting being made too rigid to constitute an adequate mechanical filter. When the motor is attached to an automatic record player it is usually impossible to incorporate rubber, owing to the necessity for preserving spindle alignment in all circumstances.

Interference

By interference is meant any spurious vibrations injected into the pick-up, either electrically or mechanically, and amplified and radiated into the room by the speaker. Electrical interference results when any a.c. leakage field from the motor coils cuts the pick-up coil.

The leakage fields for different types of motor vary greatly both in strength and in shape. Electrical interference can generally be reduced (a) by enclosing the motor in an iron casing, (b) by orientating the motor to the most favourable angle relative to the pick-up head, (c) by lowering the motor some distance beneath the motor board, (d) by attaching metal screening plates to the motor board, and (e) by using hum-neutralising coils either in the motor or in the pick-up, or in both. (a) and (b) are the methods to adopt where possible as there are no extras involved. One of the main disadvantages of turntable phonic motors is that the stator coil is very close to the pick-up, the two coils often having parallel axes, which makes matters worse. Both (d) and (e) are useful methods of tackling the problem when (a), (b) or (c) cannot, for other reasons, be adopted.

A pick-up connected to an amplifier and speaker constitutes a very sensitive vibration detector, and when the needle is resting on the record any vibration of the latter derived from the motor excites the pick-up and produces hum. Vibrations picked up in this way are of two sorts. If the instrument is capable of reproducing very low frequencies, practically all motors will be found to cause a kind of rumble as a background in the reproduction. This is caused by mechanical clearances which are necessary for the motor's operation. A loose turntable, again, may considerably augment this noise.

The second class of hum picked up directly is restricted to a.c. motors, and has mainly a frequency of twice that of the supply. This type of vibration arises from imperfect rigidity of parts subject to alternating flux, to pulsating torque due

* *Wireless World*, June 15th, 1934.

† Knudsen. *Physical Review* No. 22, Jan., 1923, p. 84.

to imperfect phase splitting, to the use of a commutator and to inequalities in air-gaps. Some types of motor are more prone to this class of vibration than others. In turntable motors, for instance, the rotor or armature is directly attached to the turntable spindle, and vibrations are more readily transmitted directly to the turntable. In high-speed squirrel-cage motors, on the other hand, the rotor drives the turntable spindle through gearing which acts somewhat as an elastic coupling and, as such, may reduce turntable vibration.

Some interesting problems may arise in attempting to eliminate this second class of vibration. For instance, while vibrations may be transmitted up the turntable spindle to the record, they may also travel via the motor frame, motor board, pick-up base and arm, so that the head of the pick-up may be vibrating. Sometimes it is possible to make these vibrations practically equal in amplitude but opposite in phase with almost complete elimination of the hum.

Often it is stipulated that the motor must be capable of working over a fairly wide range of voltage and frequency, and a more expensive and less satisfactory motor may have to be used, although if the operating range were restricted, a cheaper and better motor would be available.

The operating ranges of various types of small motors of the class considered are briefly as under:—

(1) Universal commutator motors.—One motor can be designed to cover 100-250 V d.c. and 100-250 V a.c. 25 to 100 cycles using a series resistance. Usually to provide a cheaper motor the range covered is restricted to supplies commonly encountered, *i.e.*, 100-130 V and 200-250 V d.c. and 100-130 V and 200-250 V a.c., 25, 40 and 50 cycles.

(2) Induction motors.—One motor will cover a frequency range of about 20 cycles if of the slow-speed disc type. High-speed, squirrel-cage motors will work satisfactorily over a range of about 10 cycles only. Series-parallel connections for coils enable one motor to work over voltage ranges of 100-130 and 200-260 V respectively.

(3) Synchronous phonic and hysteresis motors.—The voltage range is identical with that given for induction motors. The frequency is restricted to one value.

Cost will depend mainly on the simplicity or otherwise of the motor and on the demand for the particular type. At the present time the lowest-priced machines on the retail market are high-speed squirrel-cage induction motors and turntable-speed synchronous motors. These are followed closely by high-speed hysteresis motors. The most expensive class is the universal a.c.-d.c. motor, mainly on account of its greater complication.

Special shapes are sometimes called for by makers of radio gramophones to avoid obstructions beneath the motor board. Generally, shallow motors are preferred. High-speed motors, driving the turntable spindle through gearing, are generally the most compact. This is partly because the efficiency of the motor is usually greater than that of the corresponding turntable-speed type and partly because the orthodox layout lends itself very well to incorporation in gramophones.

The parts which normally give trouble first through unavoidable wear and tear are the commutators in high-speed universal motors; next come governors and bearings. Slow-speed phonic motors offer the greatest possibilities.

Increasing attention is being given to the provision of lubricating-oil reservoirs for bearings and to facilities for lubricating the motor completely without removing the motor board. If lubrication is neglected the bearings wear, and in the absence of an oil film in them the motor becomes noisy. Complete stoppage is usually due to failure of an electrical component, such as a coil or a condenser.

Acknowledgments are due to the Gramophone Co., Ltd., for facilities provided in connection with this article.

Outdoor Surge-testing Equipment

Maximum rating 3,000,000 V

THE Siemens-Schuckert Co. has recently installed at its transformer works at Nuremberg, Germany, outdoor surge-testing equipment with a maximum rating of 3,000,000 V and 42,000 joules. Notwithstanding the special provisions which had to be made to guard against considerable wind pressures and varying atmospheric influences, it was decided that an open-air installation would not only be less costly than an indoor one, but also that it would possess certain advantages, particularly in connection with any later need for increasing the capacity of the installation. It was not overlooked that the generator cannot be used during rainy weather.

The generator base is relatively small, being approximately 17 ft. 2¾ in. by 16 ft. 6 in., and the condensers are not arranged vertically but in steps, mounted on a framework about 39½ ft. high. The main frame consists of six columns built up of porcelain insulators, cement and cast-iron, rigidly coupled together near the foundation by an iron frame. Only one of the columns is bolted to the foundation, the others being free to slide on brass plates. The generator is of the Marx type, comprising fifteen groups of four 0.14 μF condensers, each set of four being connected two in parallel and two in series. The dielectric consists of oil-impregnated paper, designed for 125 kV, but tested up to 188 kV.

Comprising the 100-kV charging equipment there are a transformer and two rectifier bulbs, which are so connected as to embrace both the positive and negative half-waves. Although intended to operate at 200 kV, the rectifier bulbs are constructed for a locking-out voltage of 250 kV and were tested up to 320 kV. The charging resistances are glass tubes filled with a mixture of distilled water, glycerine and tartaric acid. The sparking spheres have a diameter of 150 mm., the lower one being adjustable by means of an electric motor; the distance between the spheres is signalled to the control office to a degree of accuracy of plus or minus 1 mm. The priming sphere has its frame insulated from earth, with its control circuits protected by condensers, the remaining spheres are hand controlled and coupled by porcelain rods. Concrete poles with swivelling arms are provided for suspending the insulation chains and test electrodes.

When the generator oscillates freely, the current in the discharge circuit attains a maximum amplitude of 25,000 A. In the case of aperiodic discharge the maximum is, however, about 10,000 A. When the discharge takes place the whole of the fifteen groups of condensers are connected in series, so producing 3,000,000 V to earth.

Damping resistances (wire non-inductively wound on asbestos-slate rods) inserted in the circuit serve to reduce the high-frequency oscillation resulting from the self-inductance of the generator and its capacity in relation to earth. An earthing switch enables the generator to be released of its charge at any time. That which, as a result of certain dissymmetries, may remain in the ironwork and on the centre points of the individual condenser groups is also dissipated by means of resistances. The rectifier bulbs and the charging resistances are so designed that the surges may follow one another at intervals of five seconds. An earthing connection with a resistance of 6 ohms is provided for the generator and the appliances under test; this resistance consists of a number of 3 in. galvanised iron pipes, 26 ft. in length, standing about 7 ft. deep in underground water.

General view of the 3,000,000-V outdoor surge-testing installation at Nuremberg

Those parts of the equipment which cannot remain constantly in the open air are housed in a large hall adjoining the control office. A second generator of 1,000,000 V and 7,000 joules for testing small appliances is also provided in the hall, switchgear and charging equipment being common to both.

Fire Risks. By W. Kidd, M.I.E.E.

How they can be reduced in power stations and large sub-stations

Mr. W. Kidd is with the Manchester Corporation Electricity Department

DURING the last few years the consequences of switchgear and turbine oil fires in America, on the Continent and in Great Britain have caused keener interest to be taken in the design of plant, generating stations and sub-stations to reduce the hazard to a minimum.

Absolute elimination of fire risk is not practicable; the amount of money that may justifiably be spent is, therefore, a matter for judgment of the probabilities of fire occurring and its likely consequences in each case. The following notes indicate some of the means, many of them quite inexpensive, that may be adopted to deal with existing installations and also for consideration when planning new sub-stations and generating stations. The subject may be divided broadly into three sections, namely, prevention of fire; minimising damage; and extinction of fire.

Preventive Measures

It is very necessary that only high-grade equipment shall be used, because almost any failure of electrical gear may be the cause of fire developing. Oil circuit-breakers have more reliable and stable operation characteristics than formerly, but the trend, both in this country and America, towards metal-clad gear has introduced features, *e.g.*, oil and compound-filled chambers and close proximity of cables to circuit-breakers, which are undesirable. It may be news to many that alloy metal of such a low melting point has been used for chambers that, when fire has occurred, it has melted and so supplied additional fuel to the conflagration. Manufacturers should give serious thought to any modification of their designs that may be requisite to guard against these risks which do not exist to the same extent in some types of cellular gear.

It is natural that thoughts should be turned to water and air-blast circuit-breakers, non-inflammable filling for chambers and transformers, but the deleterious effect of non-inflammable oil on some insulation materials, and the price quoted for it, leads to the feeling that the fire risk may be the lesser evil.

The potentially dangerous parts of old switchgear are unsuitable and deteriorated insulation, inadequate thermal capacity of equipment, and circuit-breakers of too small a rupturing capacity. Porcelain insulation does not deteriorate, but trouble may develop from external sources, *i.e.*, cement, stresses causing fine cracks, and discharges damaging the surfaces. More risk probably exists in the early types of synthetic-resin bushings, which were made when little knowledge was available about the design and manufacture of condenser bushings, minimum diameter of conductors in bushings, grading, &c. A discussion of these matters with the suppliers will help to decide whether or no replacements are necessary.

The thermal capacity of earth connections is sometimes inadequate, especially if protective gear has been modified and time-delay settings increased. Sizes should be checked to avoid the disappearance of conductors during severe fault conditions, and, consequently, the prevention of gear operating.

Oil-immersed, wound-primary type current transformers are common on old cellular gear and the majority could, with advantage, be replaced by open-type bar-primary transformers, which are much more suitable for carrying the larger fault currents now encountered. Similar remarks also apply to metal-clad switchgear. A perusal of the British Standard Specification for Current Transformers, No. 81-1936, Appendix C, will amply repay those who wish to obtain more information on the suitability of transformers for modern conditions.

Superfluous Voltage Transformers

Voltage transformers, especially on high-voltage systems, should be avoided wherever possible. The number installed is frequently excessive, and there are few old installations where some of the transformers could not be dispensed with. Synchronising systems can be redesigned to eliminate bus-bar voltage transformers by arranging to synchronise between machine transformers. Feeder transformers should also be omitted if they are not really essential.

Most of the old circuit-breakers are not equal to the increased rupturing capacity now necessary due to growth of systems, but a much more serious matter is that the ratings assigned to breakers some years ago were unduly optimistic. Replacement is the only sensible way of dealing with the really "ancient mariners." In other cases arc-control devices may be added, but careful consideration must be given to such items as strength of tanks and method of fixing top insulators, otherwise it might be a case of "putting new wine into old bottles." How many engineers realise that they are unwittingly contravening the Electricity Supply Regulations, 1934, (No. 13) by retaining unsuitable circuit-breakers in commission? Financial considerations may preclude replacement of all weak equipment, but fortunately it is possible to do a great deal of inexpensive work which will have the effect of reducing the fault current on supply systems. Fault kVA may be reduced by sectionalising the generating plant, the transmission and distribution systems, for normal operation, probably without any expense if duplicate bus-bars exist. In fact, it is stipulated in the Electricity Supply Regulations, 1934, (No. 21) that systems shall be sectionalised to restrict the area of supply affected by faults. Efficiency of distribution is important, but reliability of supply is of greater consequence.

As a very rough approximation the commercial limits of sub-station switchgear breaking capacity may be taken as:—25,000 kVA at 400 V, 250,000 kVA at 6.6 kV, and 500,000 kVA at 33 kV. On this basis, for urban underground cable systems, the low-voltage network should be divided into normally isolated sections, each having a total transformer capacity limited to 3,000 or 4,000 kVA, with corresponding 6.6-kV isolated sections each fed by transformers of 20,000 kVA total rating. On systems of a rural and semi-rural character using overhead lines, it is permissible to increase the transformer capacity feeding the high-voltage system. Reactors, unless judiciously placed in the system, may lead to serious voltage regulation trouble and should not be regarded as a cure for all troubles.

Improvements in the design and manufacture of protective gear have increased its reliability; more consideration is given to the selection of suitable gear for the duty, and those little "snags" which represent the difference between good and bad installation are avoided.

How much of the older protective gear is quite satisfactory for ensuring the immediate isolation of faulty equipment and cables to avoid fire due either to arcing or to overheating? All electrical gear should be within a protective zone, but is it? Are all bus-bars protected or are engineers still waiting for a protective system which they dare put on a generating station bus-bars? Do protective transformers of adjacent sections overlap to ensure that the transformers are themselves protected?

Restriction of Area of Damage

There is little likelihood of fires occurring in cable passages and trenches if good electrical protective gear for the cables is installed and external fire prevented from entering. It is presumed, of course, that all cables have metallic external surfaces and that all inflammable covering, if it existed, has been removed.

Care is especially required to ensure that the control cables are safeguarded from damage and, if necessary, their routes should be altered to remove them from a danger zone. A really serious state of affairs exists when control cables are out of use and circuit-breakers cannot be operated.

As oil can be ignited by contact with hot surfaces such as steam pipes—some forms of lagging may become saturated, cracked, knocked off, and joint covers are not always replaced—barriers should be installed between cables and pipes of turbine oil systems and steam pipes, &c.; where this is impracticable, then metal cleating is necessary over the steam-pipe lagging.

The spread of fire into other rooms by flowing oil and the torch-like burning of cables has been one of the most serious factors in causing widespread damage. Sectionalisation and segregation of electrical plant is recognised as being the correct practice in new installations, but how many old installations are being modified to conform with the better practice? The sub-division of switch rooms and their corresponding sections of cable passage cannot be done effectively in all existing installations, but the exercise of some ingenuity, the use of bricks, asbestos, and other non-inflammable materials will enable a large amount of sub-division to be effected. Thus brick walls can be built to divide metalclad switchgear into sections, the interconnecting doors being fireproof and having thresholds to prevent oil flowing under them.

Transformer chambers should have dwarf walls (of sufficient height to retain all the oil in the tanks) built across the inside of the door. Such walls are low enough to be easily stepped over and readily knocked down and rebuilt when necessary. Only in exceptional cases will they adversely affect the cooling of the transformer. Similarly, walls are desirable round outdoor transformers to prevent spread of oil to other units.

Trenches behind and under switchgear present a rather difficult problem. If permissible, they can be concreted over the chequered plates; alternatively, they may be filled with sand or pebbles. Oil-soaked sand, however, is not nice material to remove, and when sand is used the current rating of cables may have to be reduced. All cable and oil-pipe trenches should be sectionalised by means of cross walls. Short lengths of cable trench where cables enter may, with advantage, be filled with gravel. Great care is necessary to ensure that the effectiveness of work of this type is not nullified by the existence of small holes.

If a cable is ignited it will burn back, melting the lead as it burns like a torch; wire armouring will be left like a cage. Plumbing metal has a lower melting point than lead sheathing; it is, therefore, not unknown for cables to drop out of the sealing boxes. Thus, adequate cable supports are necessary. All cables between the floor and the switchgear should be encased in fireproof material, with concrete plinths and fireproof packing at floor level. If asbestos tape wrapping is used it is desirable that it should be coated with silica paint, as recommended by the Electricity Commissioners.

Prevention of oil passing through cable holes in floors is absolutely essential. If hardwood cleats are fitted at floor level they should be concreted over. Sub-stations, and especially those on consumers' premises, may be damaged by fire from outside and, therefore, should be in fireproof enclosures.

Extinguishing Fires

A fixed system of fire extinguishing equipment is most desirable in every generating station and large sub-station. A portable equipment is unsuitable for turbine-oil pipes, mainly on account of the difficulty of quick and easy access to the source of the fire. Small distribution sub-stations, usually, do not need elaborate gear on account of the comparatively small cost of the electrical installation and the rapidity with which supply could be restored after a fire, but some portable gear is necessary to deal with small fires.

An outdoor transformer and similar high- and low-voltage switchgear, which can be easily transported to any part of the system, form a valuable portable sub-station for temporary use if plant has been put out of use by fire or electrical fault or for alterations.

There are, broadly speaking, two methods of extinguishing fires, namely, (a) by lowering the temperature, and (b) by reducing the amount of oxygen available.

Oil, unlike insulation, does not burn; it would be more correct to say that it is the vapour given off that burns. The use of an ordinary water-hose jet, unless large quantities are used, may assist the fire to spread. The water should be applied either in the form of foam or projected by a special system of jets, which prevent the formation of inflammable vapour and are satisfactory extinguishing mediums. Carbon dioxide and other gases are also effective.

Insulation for electrical gear is not damaged by contact with CO_2, which also has a higher dielectric strength than air; it is therefore possible, after using CO_2 to extinguish a fire, to isolate the faulty equipment and put adjacent gear immediately back into commission. The quantity of CO_2 required varies according to the circumstances in which it is to be used, *e.g.*, height of room, openings in walls. The ambient atmosphere should contain not less than 50 per cent. CO_2, and for chambers with an open side three times as much gas may be needed. As re-ignition has to be prevented, the dilution of the air must be maintained at over 17 per cent. CO_2 until the material which was burning has been cooled sufficiently to prevent re-ignition.

An important matter to be attended to on water installations is the maintenance of adequate pressure at the nozzles, usually about 100 lb. per square inch. Low pressure in the town's main, incrustation in pipes, &c., may be the cause of insufficient pressure at the time of a fire. New pipe lines and a booster pump may be required, for which a reliable supply of energy is, of course, essential. Steam pumps which automatically come into service are recommended for generating stations.

Oil fires are accompanied by the formation of dense black smoke, which may prevent approach to the source. Gas masks should always be available and a staff must be trained in their use. Small fans quickly remove smoke and fumes from a switch-room after (not during) a fire; the fan switch should be fixed outside the room, as otherwise a considerable period may elapse before safe entry is possible. Usually it is impracticable to provide oil drainage from existing floors, but all new floors for large gear should have falls to drain pits, which should have a pebble filling to cool and extinguish burning oil.

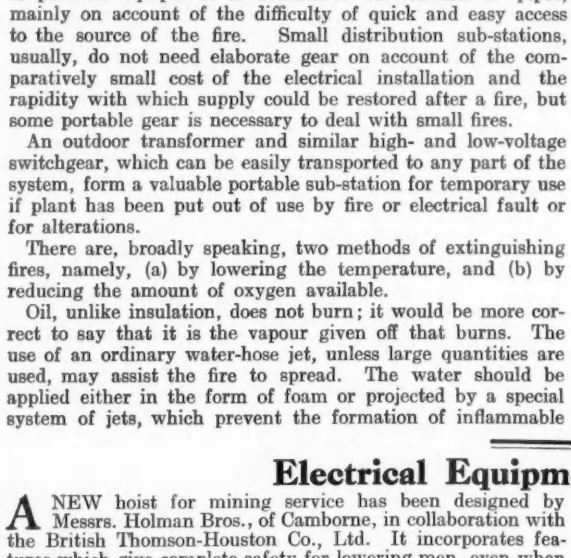
Periodic Testing

There may be some difference of opinion about the value of the information obtained from periodic testing for preventing fires as distinct from other electrical failures; "Megger" tests on high-voltage gear are not enough for this purpose. The rate of deterioration of insulation may sometimes be extremely rapid, and periodic tests would not be helpful; porcelain insulators may be damaged by expansion of conductors during the period of an unusually large through current. It is doubtful whether the adverse effects of frequent high-voltage tests will not counter-balance the value of the information gained. In addition to inspection, the measurement of power factor and capacitance of such insulation as bakelite would probably be more useful if reliable figures could be obtained for each item of insulation; otherwise it would not be possible to locate exactly where deterioration was proceeding. There are obvious difficulties in obtaining segregated figures, but possibly research by manufacturers and users (the latter should take an active interest in the matter) may result in the evolution of some satisfactory means for making tests.

Finally, so far as existing installations are concerned, the principal factors are replacement of unsafe gear and the prevention of fire spreading to other equipment.

Electrical Equipment for Small Hoists

A NEW hoist for mining service has been designed by Messrs. Holman Bros., of Camborne, in collaboration with the British Thomson-Houston Co., Ltd. It incorporates features which give complete safety for lowering men, even when handled by unskilled operators. The hoist is compact, and although (without control gear) it weighs only 1,110 lb., it is capable of exerting a mean rope pull of 2,300 lb. at a rope speed of 200 ft. per min. with a 15 h.p. motor. The control gear, together with a B.T.H. electro-hydraulic thrustor, enables full control for raising and lowering to be obtained with complete safety from one control gear handle without the necessity for manœuvring brakes or clutches. The slip-ring motor with totally enclosed dust-proof brushgear is coupled to the drum through a flexible coupling and totally enclosed oil-bath gearing.



A small electrically driven hoist, showing the thrustor in the foreground

The brake is normally "on," and is lifted by the thrustor only when the motor is energised. Consequently, the brake is instantly applied when the controller is brought to the "off" position, and there is no shock, as the thrustor operates smoothly yet without dangerous delay. The specially designed control gear comprises circuit-breaker with ammeter, controller and resistances enclosed in one case suitable for mining service. Overspeeding when lowering is avoided by the design of the control gear and by the automatic brake operation.

Fire Destroys Canadian Power Plant

Our Toronto correspondent reports that the Stinson plant of the Ontario Hydro-electric Power Commission was damaged by fire to the extent of between $300,000 and $400,000 on September 10th. The fire, which was thought to have been caused by a short circuit in a 23,000-V distributing cable, completely destroyed the building and its equipment, with the exception of the encased turbines. As a result of the interruption of power supply caused by the fire, operations at the Falconbridge Nickel Mines have been suspended.

Impressions of the Washington Conference

By Our Special Correspondent

We have already published reports of the proceedings at the Third World Power Conference held in Washington last month. The following notes are by a writer well known to the electrical industry who was one of the British delegation.

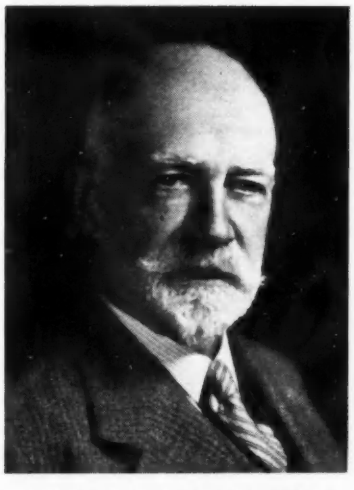
AN immense number of papers, epitomised by seventeen official Reporters, were dealt with in the seventeen sessions of the Conference, in each case presided over by a prominent American, supported by an associate chairman chosen from amongst the visiting delegation. The American National Committee, in reviewing the previous conferences in which the purely technical side of power development had predominated, had decided to emphasise the more fundamental problems of the relations of power resources, their development and use to social and economic interests.

The platform at the opening session of the conference

Each meeting was commenced by the reading by a general Reporter of a synopsis covering his carefully prepared report on the papers received, and was followed usually by the reading by a delegate of his contribution to the discussion. Only in a comparatively few cases were the remarks extemporaneous as few people had received the papers in sufficient time to give them the serious study they merited; many were only able rapidly to glance through the copies of the Reporters' synopses, which were obtainable on the spot. Consequently, whilst the meetings were well attended, and the oral contributions usually most interesting, there was a sense of detachment in these which prevented much related discussion.

Some appeared to feel that it was a little unfortunate that the meetings should happen to be held at Washington at a time when the American nation was in the throes of a presidential election and political passions were so deeply stirred. Whatever view is taken as to the propriety of mixing politics with industry, it was inevitable that the controversy of public versus private ownership should crop up, and that the opportunity should be seized, as it was, to launch a tirade against the utility companies. It was asserted that private utilities in the United States could never meet the low rates of publicly owned companies, and one speaker even went so far as to recommend that publicly owned utilities should everywhere be established in direct competition with private companies.

Municipal plants were said to have established rates as much as 25 per cent. lower than those of the private concerns. And finally it was asserted that the Public Service Commissions had been too much the guarantors of dividends to investors rather than protectors of the consuming public.



Dr. W. F. Durand, Emeritus Professor of Stanford University, California, the new President of the World Power Conference

As may be imagined, this produced some little stir, and, being sprung upon the audience, was not immediately replied to by the representatives of the American utility companies present. A British delegate stepped into the breach and urged strongly and eloquently that politics should be kept out of the utility industry. In support of his plea he outlined the happier position in Great Britain, referring to the functions and reports of the Electricity Commissioners. He maintained that the alternative to the State Commissioners was public ownership with competition, which he claimed to be more costly to the general public.

The question of the world's supply of coal and oil naturally occupied a very prominent position in the Conference, and it was discussed on the very first day. It was pretty generally agreed that the future of the coal industry would be found in the discovery and application of new uses for coal. The question of price control was touched on, and the American delegates were insistent that co-ordinated "output control" must be fully operative for any price-control scheme to be successful.

The French delegates made reference to their "quota" method of purchasing coal and the control of prices, and the Germans pointed to their inventions and the successful development of by-products as a great assistance to their country.

The exhaustion of the world's oil supply in the next twenty years or so was predicted. It was therefore urged by some that, in addition to new uses of coal, the present use of oil should be confined to those cases where it was the most efficient agent and not merely an alternative source of power.

The American delegates pointed to the development of a new "gasoline," until recently a chemical curiosity worth £4 a gallon, and now on the market in the largest quantities at ordinary prices. It is said to increase the speed of automobiles and airplanes by 30 per cent.

In a short report such as this it is impossible to do more than touch quite briefly on one or two of the many interesting and important contributions presented to this great gathering of experts from many nations. The paper on (1) Significant Trends in the Development and Utilisation of Power Resources, presided over by Mr. G. Dunn, president of J. G. White Engineering Corporation, that on (2) Organisation of Private Electric and Gas Utilities, and (3) Public Regulation of Private Electric and Gas Utilities, were so interesting that they certainly deserve mention. Mr. Dunn, opening the discussion on the first, drew attention to the importance of watching the trend of the social and economic developments in the use of power just as the trend of the stock markets and political movements are watched. He prognostigated that Dr. Abbot's heat collector of the sun's rays, now so well developed, was destined at no distant date to enter the commercial field.

After the general Reporter had read his synopsis of the papers presented, Great Britain's contributions to the discussion came from Lord Falmouth and Mr. C. H. Merz, who did much to correct the erroneous idea somewhat generally prevailing that in Great Britain the grid system had been imposed on the electrical industry by the Government instead of having originated through the direct efforts of the leaders of industry themselves.

Mr. J. M. Kennedy also emphasised the absence of any political control, and mentioned the fact that the grid was

neither owned nor operated by the Government, having been financed as a public investment. He stressed the reduction in spare plant which it had effected.

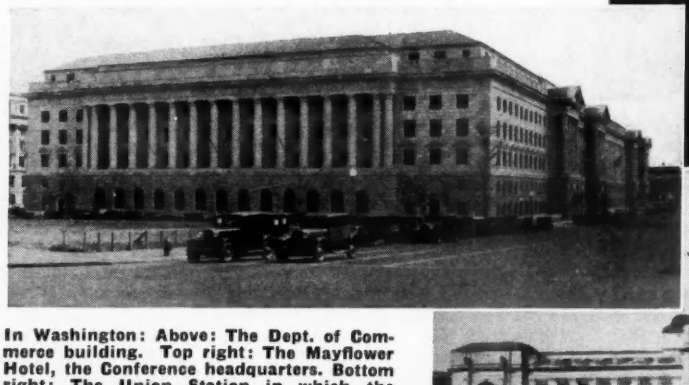
In the United States, a speaker said, the grid system had been carried to a high degree of perfection in economy, efficiency and reliability. Large units were almost universal all over the country. Power was distributed over wide territories in great bulk. It was evident, however, that the speaker was not familiar with the British grid system, using the term "grid" more in the sense of interconnection, but not as a co-ordinated system embracing the whole country.

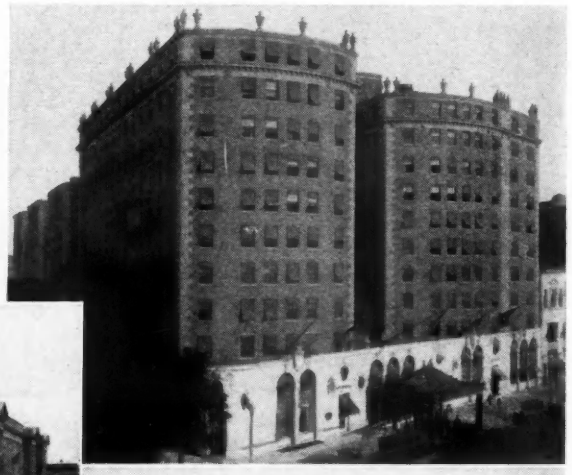
It was suggested that the electric power system centred in Los Angeles, and that part of the coast of California very much resembled the British grid both in character and extent.

It was interesting to hear from the Swiss that 76 per cent. of their railways are now electrified, and that 98 per cent. of all domestic dwellings are served by electricity, due entirely to the efforts of organisations run by the municipal or canton authorities or by private concerns. The Italians were most insistent regarding the absence of any Government control over their industry, and said that no ruinous competition was possible under their corporate organisation.

The paper on public regulation of private electric and gas utilities brought out the various methods employed in different countries for the purpose of securing fair prices to the consumer. These included control through Government concession, control by means of State commissions, the use of figures of public electric light and power authorities as a "yard stick" to gauge the rates of the private companies; and there are, of course, completely uncontrolled companies and plants publicly owned.

On the one hand, it was pointed out that there was not sufficient flexibility in some concessions, and that rates could not be adjusted to meet varying conditions, although in Argentina an economic index figure was said to be successfully employed to govern the rates charged. On the other hand, as already mentioned, the valuation procedure of the State Commissions was said to be difficult and costly, and it seemed to be the opinion of a good many that it was more a question of the spirit of justice and fair dealing underlying the service than the actual procedure which was the most important factor, since the widely varying conditions which existed in different countries required different methods of treatment.





In Washington: Above: The Dept. of Commerce building. Top right: The Mayflower Hotel, the Conference headquarters. Bottom right: The Union Station in which the banquet was held

Certainly the right of the privately owned companies whether electric or gas to higher dividends if they can earn them not by increasing but by reducing their prices was fully recognised and accepted.

The subject of rural electrification was discussed on a report put forward by a representative of the United States Rural Electrification Administration. Whilst there has been marked progress during the past ten years, it appears that comparative measurements of the extent of rural electrification in the different countries is hampered by the absence of any standardised nomenclature.

Even the term "rural area," so commonly used, has, so far, no uniform interpretation. In the United States six million out of the seven million farms are without electric power and about 36,000 miles of rural lines are being installed this year. Most rural lines are owned by private companies.

Demonstration farms, it was stated, existed in England, Germany and Sweden, and reference was made to the E.D.A. and its most useful service to the farmer in Great Britain. In the States the Rural Electrification Administration is providing credits for financing wiring as well as for the acquisition and installing of plumbing equipment in farms. Credits are also available to the farmers for electrical appliances and technical advice and assistance is given by the R.E.A. and the Tennessee Valley Authority, both being under the Government.

A newly electrified farm named Rosedale Dairy Farm, about twenty miles from Washington, was open to the inspection of the delegates to the Conference and was visited by many of them. There did not appear to be anything strikingly original except, perhaps, the electrified single-wire fencing, which seemed to function very well in keeping both pigs and cattle from straying. Both the cost of erection and time required to erect it must be very small. Another feature was a particularly silent petrol-driven tractor with large pneumatic tyres, and a radio set to enable the operator to listen in whilst he rode the tractor up and down the field.

The conference was honoured just before its close with the presence of Mr. Roosevelt. At the closing session Dr. Durand, Emeritus Professor of Engineering, of Stanford University, California, was elected the new President of the Conference, and short speeches followed from the British (Sir Harold Hartley) and other delegations.

Thus came to its close the Third World Power Conference, which was attended by about 1,200, including over seventy British delegates, making it the largest international conference ever held in America. It could hardly have had a more delightful setting, and praises of the beauty of Washington could be heard on every side.

Its careful planning, its handsome and well-matched public buildings, its wide avenues and shaded streets and side walks, its beautiful parks and superb monuments, delighted everyone, and it was generally voted one of the most beautiful capital cities of the world. The sun shone and the weather was really hot, but the majority of the hotels and Government auditoriums were air-conditioned and delightfully cool. There was abundant entertainment, a ball, a garden party, a river trip to Mount Vernon, Washington's home, and a huge banquet at the Union Railway Station.

The last was a great novelty to the visiting guests, and the City of Washington is hoping to build a civic hall suitable for such functions, as it is the one thing lacking in their magnificent modern city. Still, it must be remembered that the principal railway stations in U.S.A. look, to our ideas, more like cathedrals than stations. The drawback on this occasion seems to have been the tremendous echo.

Besides the large official functions, in which must be included a splendid dinner at the Astor in New York given by the Consolidated Edison Co., there were many smaller, but no less enjoyable, ones, and some of the Embassies seemed indefatigable in entertaining their nationals.

After the dinner in New York many of the guests were leaving on one or other of the specially arranged study tours, the most ambitious of which included a visit to the Grand Canyon, the Boulder Dam, and the Yosemite Valley, the latter involving nineteen nights in the train!

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

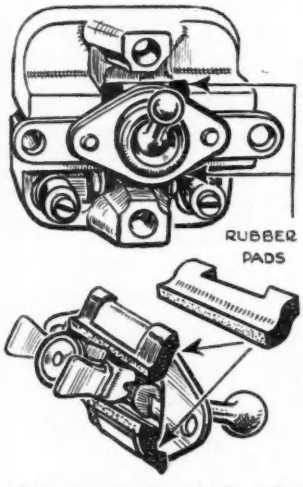
The "Highlow" drying cabinet

A Drying Cabinet

The "Highlow" electrically heated drying cabinet made by MESSRS. ARCHIBALD LOW ELECTRICS, LTD., Newarthill, Motherwell, Lanarkshire, has a strongly constructed cabinet of sheet steel with a side-hinged door fitted with a nickel-plated handle. An arrangement of racks is provided to take linen and other articles which require warming or drying. The heating elements, which are mounted in the bottom, are easily accessible; they are protected by insulating material and a strong wire guard. A three-heat control switch is mounted on the top of the cabinet, giving loadings of 725 W, 1½ kW and 3 kW. It is 2 ft. wide, 2 ft. deep and 6 ft. high.

A Silent Action Switch

The "London" underslung switch manufactured by MESSRS. A. P. LUNDBERG & SONS, LTD., 477-489, Liverpool Road, Holloway, London, N.7, which was described in the ELECTRICAL REVIEW of January 10th, 1936, has now been made available with a special silent action. This has been brought about by the incorporation of a rubber mounting, which is clearly shown in the accompanying sketch.



The construction of the silent action "London" switch is shown in this sketch

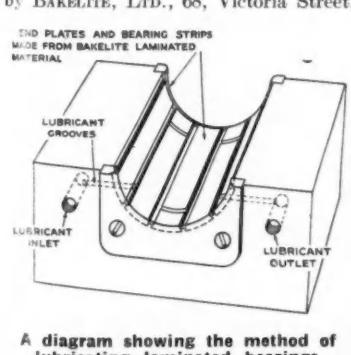
The new form is applied to both single- and two-way types in surface, semi-recessed and flush patterns.

A Low-priced Electric Hair Dryer

The AUTO-MAID ELECTRICAL CO., 62, Blandford Street, London, W.1, informs us that it is now marketing a low-priced hair dryer, known as the "Gem." It is light and of compact construction. The metal casing is finished in mottled enamel, and an insulated handle is provided. The air intake is at the back, so that there is no possibility of the hair being drawn into the dryer. The heater has a 400-W element, and the apparatus can be operated on 230/250-V supplies.

The Lubrication of Laminated Bearings

A method of lubricating bearings incorporating laminated fabric impregnated with synthetic resin has been developed by BAKELITE, LTD., 68, Victoria Street, S.W.1, for use under arduous conditions such as those found in rolling mills or in pumps for liquids, including acids and mild alkalis. In the example illustrated a standard metal housing has been machined so that 2 in. wide by ⅜ in. deep grooves run coaxially with the centre of the bearing. Into these grooves are introduced the laminated material, and the bearing so built up is machined to size, end plates being fitted to reduce the chance of lubricant leakage and to take up side thrust.

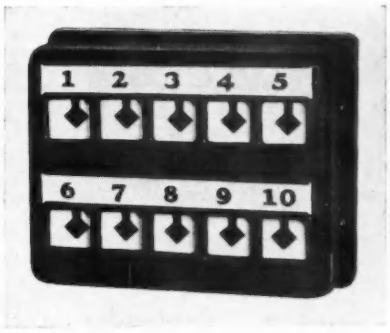

END PLATES AND BEARING STRIPS MADE FROM BAKELITE LAMINATED MATERIAL
LUBRICANT GROOVES
LUBRICANT INLET
LUBRICANT OUTLET

A diagram showing the method of lubricating laminated bearings

In smaller applications blocks of material machined to size can be installed. The most satisfactory lubricant for all speeds and for loads up to 4,000 lb. per sq. in. is water mixed with a water-soluble oil free from acid and alkali; for loads not exceeding 2,000 lb. per sq. in. water alone may be used where the presence of oil is undesirable.

A Pendulum Electric Bell Indicator

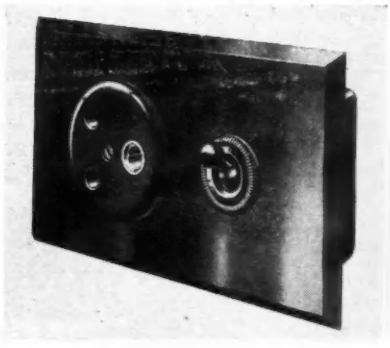
The construction of the new "Longswing" type of pendulum used in the domestic bell indicators of the PHŒNIX TELEPHONE & ELECTRIC WORKS, LTD., 38, Newman Street, Oxford Street, London, W.1, is such that the pendulum vibrates for two minutes after the initial operation. The apparatus is very compact, the ten-hole indicator measuring only 6¾ in. wide and 5½ in. high, with a projection of 2½ in. The base is constructed of moulded bakelite, and the cover is of drawn metal finished in brown crystalline enamel. A ticket frame is incorporated to accommodate numerals or names of rooms (about fifty popular names are held in stock by the makers). The indicator can also be obtained for recessing into the wall; for this purpose the containing case is of sheet metal and the front plate of brass.



A ten-hole "Longswing" indicator

"Tenbyluxe" Switch-sockets

In general arrangement the design of the new "Tenbyluxe" three-pin, 5-A switch-socket follows that of the two-pin type.



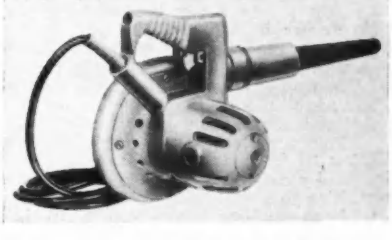
The "Tenbyluxe" switch-socket, and (right) the shutter mechanism

The live and neutral socket tubes are of one-piece construction, while the earth socket is securely fastened to the earth terminal plate through which pass the fixing screws that earth the socket when fixed in conduit boxes.

Deep recesses are provided in each corner of the sunken plates so that holes can easily be drilled right through when it is desired to fix the unit by screws through the corner of the plate. A shutter mechanism is incorporated. The makers are MESSRS. S. O. BOWKER, Regent Row, Birmingham.

Portable Electric Blowers

So far as machinery is concerned the most convenient method of removing dust is by means of compressed air, but there are conditions where suction cleaning is preferable. A portable electric blower which has just been introduced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, is designed to serve both purposes, a few simple accessories enabling it to be converted from blowing to suction cleaning when required.

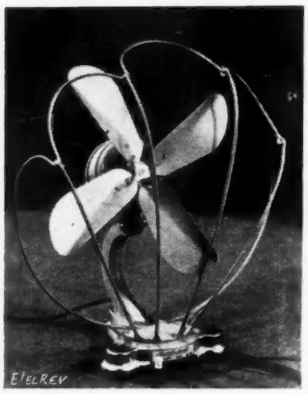


The new G.E.C. portable electric blower

These blowers are made in two

sizes suitable for the requirements of factories of all kinds. Both are designed to be light in weight and comfortable to handle, the weight (including the cable) being only 7 lb. in the small size and 10 lb. in the larger size. The smaller blower has a free air capacity (with the nozzle) of 31 cu. ft. per min. against a static water gauge of 16 in., and the larger delivers 73 cu. ft. per min. against a 24 in. water column, the nozzle velocities being 159 and 216 m.p.h. respectively. To combine strength and lightness an aluminium alloy has been used for the main body. When the finger is removed the trigger switch ordinarily returns to the "off" position; if, however, a small button at the side is pressed with the thumb the trigger switch is held on until it is pressed again.

Ten feet of t.r.s. cable with an earthing core, a 12-in. insulated blowing nozzle, and a spare pair of carbon brushes complete the equipment.



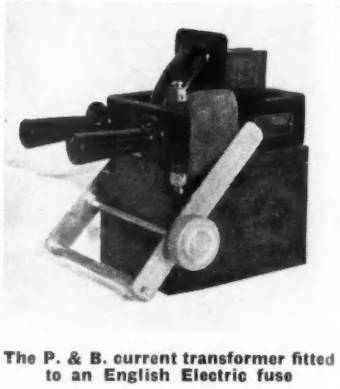
The Graham Farish fan

The "Aeroficient" Fan

The "Aeroficient" fan, a product of MESSRS. GRAHAM FARISH, Bromley, Kent, has a guard of unusual design, and the motor is of the a.c. induction type, giving at full speed a blade speed of 1,360 r.p.m. Two lower speeds are provided, and the position of the motor and blades is adjustable over a wide arc. In addition, holes are provided in the base so that the fan can be fixed on a wall or a wall bracket. The diameter of the blades is 12 in., and the standard models are for 200/220 V and 230/250 V.

Fuse-type Current Transformers

With modern tailless units it often happens that there is no place to accommodate a current transformer to measure the maximum load on a feeder, except round a fuse handle. On many fuse boards, however with the centres between the fuse handles and the space behind them reduced to a minimum, there may be insufficient room for a split core current transformer of a standard pattern. For such positions the P. & B. ENGINEERING CO., LTD. Tamworth Lane Works, Mitcham, has designed a special fuse-type transformer which is generally suitable for use on a variety of makes of fuses of either the rewireable or cartridge type.



The P. & B. current transformer fitted to an English Electric fuse

The illustration shows the transformer assembled round an English Electric fuse handle, but it is equally suitable for use on Henley and Lucy fuse handles, among others. The core is split at the front and back each half being fitted with an insulated handle for placing the core in position round the fuse handle, where it rests on a teak wood stand. The two halves of the core are firmly held together by means of a spring steel stirrup which has projections on the ends of the arms engaging in indents in the core shrouding. After the stirrup has been placed in position the blind knurled nut is tightened up to its full extent which always ensures the same constant pressure on the core joints. If there is insufficient room to shut the door of the fuse pillar with the insulated handles in position they can be removed by simply unscrewing them. This transformer is intended for use with a portable maximum load indicator or a portable recording ammeter, so that the whole set can be moved from one feeder to another very easily as required. It has a load of 5 VA at the standard frequency of 50 cycles and unity power factor, the limit of ratio error at the rated load being 5 per cent., in accordance with Class D of B.S.S. No. 81. It is made in ratios of 150/5, 200/5, 250/5 and 300/5 A.

Electric Laundry Equipment

FOLLOWING the success of their "Streamline" iron, H.M.V. DOMESTIC APPLIANCES, LTD., 363, Oxford Street, London, W.1, are introducing a complete range of washing machines, ironers and drying cabinets of artistic design.

Exceptionally large tubs enable the "76 P" washer and the *de luxe* model, "86 P," to deal with 9 lb. of dry wash each, the smaller "66 P" and "46" types having capacities of 7 lb. each. With the exception of the last mentioned, all machines are fitted with draining pumps and are finished in white porcelain enamel with black lids, legs and "trimmings." The "46" has a green enamel finish.

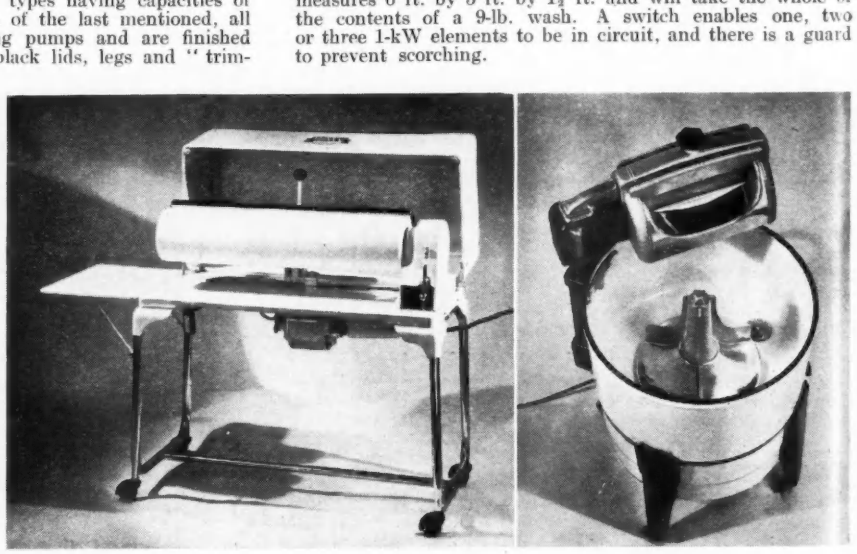
The cast-aluminium agitator operates at the high speed of 120 to-and-fro motions per minute, and its fins are carefully tapered and rounded to avoid any possible damage to articles being washed. A minimum of soap is required, and Mr. S. E. Arridge, sales manager of the H.M.V. Home Laundry Section, tells us that the time taken for washing a tub-full of clothes is six minutes. The agitator and pump controls are so situated as to be easily operated by hand or foot.

It is noteworthy that the agitator and wringer may both be in operation at the same time. Balloon rubber rollers on the wringer provide a constant pressure, whatever the thickness of the article passing through, and there is a novel release which functions upon sharply striking a bar along the top. No matter in which of the six positions the wringer may be, the automatic drip pan ensures the return of the water to the tub.

The washer is fitted with rubber casters, and a useful refinement is a knob on the lid of the washer for hanging it on the side of the tub. The approximate loading is 250 W.

Three new ironers have 26-in. rollers and shoes, the fourth being 30 in. long. Two models have three heats, thermostatically controlled, the elements being chromium plated. In addition to a well-placed knee control, there is a hand switch, while an auxiliary release enables out-size articles to be accommodated. An adjustable flap is provided at the side, and, being 30 in. high and 18½ in. wide, the ironer, with its cover on, forms a useful kitchen table when not in use. As in the case of the washers, the cheapest model is finished in green and the remainder in black and white. The average consumption is about 1¼ units per hour.

For the final airing process the company's new drying cabinet is obtainable, also finished in black and white. It measures 6 ft. by 3 ft. by 1½ ft. and will take the whole of the contents of a 9-lb. wash. A switch enables one, two or three 1-kW elements to be in circuit, and there is a guard to prevent scorching.



The recently introduced H.M.V. wringer and washer

Compared with last season's corresponding models, the new "Universal 470 and 670" electric washing machines just introduced by BRITISH NATIONAL ELECTRICS, LTD., Clyde Crane Works, Mossend, Lanarkshire, are considerably cheaper, in spite of a number of improvements.

Four legs, instead of three, render the machine much more stable, while a new type of automatic release has been incorporated in the wringer. The latter is clutch-driven by a ¼-h.p. motor, which also operates the agitator and, in the case of the "670" model, the pump for emptying the tub. Grey enamel with a black rim round the top of the tub has been adopted as the standard finish.

New Books

Experimental Electricity. By M. M. DAS. Part I; Pp. 334; figs. 236. Price 4s. 6d. Part II: Pp. 98; figs. 73. Price 3s. 6d. London: English Universities Press, Ltd.

The two parts of this book are at the same time complementary and independent. The author's aim in Part I is to produce a treatment on electricity suitable for students at secondary schools, and technical schools and colleges, from an essentially experimental and practical standpoint. On account of the difficulty in including in such a scheme many of the rather more academic proofs and calculations in magnetism and electrostatics commonly demanded by examining bodies, these have been included in Part II, although the treatment of magnetism and electrostatics in Part I is only such as is compatible with the object set forth, yet, in view of the disparity in the sizes of the two volumes, it would seem a matter of opinion whether the contents of Part II might not have been included with those of Part I and indicated by asterisks or other suitable instructions.

In both parts the treatment is lucid and calculated to stimulate the interest of those students whose outlook is more practical than academic and of those who, as Dr. F. J. Harlow says in his foreword, are engaged in, or being trained for, industrial occupations. An acceptable feature of the experimental instructions is the clarity with which actual quantities and dimensions are suggested. The recommendation to the student to draw circuit diagrams wherever possible shows that the author has realised and met the needs of the type of student for whom the book was written.

The text is clear and standard electrical terms are carefully explained where they are introduced. Both volumes are liberally illustrated. The applications of the principles and experiments described are very comprehensive, and are dealt with in a concise manner. A useful short section at the end of Part I dealing with the use and care of electrical apparatus is in keeping with the character of the work. A valuable part of both volumes is the large number of exercises.

The adverse criticisms are not many. Legends for the diagrams could have been more freely used with advantage. Here and there words are not well chosen, such as "inadequate" resistance, and "lamps of different watts." The figure on p. 119 shows the ammeter connected so as to include the voltmeter current. As a general criticism, we would say that in attempting to break away from the ordinary text-book treatment by divorcing the requirements of practice from those of examinations, the author might go still further and exclude much more of the old-fashioned and obsolescent matter so beloved by many physicists, and in its place give the student a sound introduction to electrical technology.

A.B.C. of Air Conditioning. By P. D. HARRIGAN. Pp. 64; figs. 57. New York: Gernsback Publications (Inc.). Obtainable from Batwin Electrical Appliances, Ltd., London, S.E. Price 2s. 6d.

This is an elementary handbook on the subject, written in simple language and suitable either as an introduction to more advanced study or as a means of obtaining a general idea of the fundamental principles of the subject and how they can be applied. In addition to descriptions of the working of typical installations, the book gives hints on the installation and maintenance of auxiliary apparatus, a glossary of books (U.S.A.) on air conditioning and a short dictionary of the technical terms used.

Dielectric Phenomena in High-voltage Cables. By D. M. ROBINSON. Pp. 173; figs. 96. London: Chapman & Hall, Ltd. Price 15s. net.

We have recorded already the first two volumes in Chapman & Hall's new series of monographs on electrical engineering, and this is the third one. The literature of cable engineering has now reached considerable proportions, both in Great Britain and abroad, but much of it is to be found in the journals of the learned societies and in the technical Press.

It must not be inferred that, because of this, a book within the modest compass of less than 200 pages must, or might, be superficial, for emphatically this is not the case. The studies presented are concerned entirely with power cables insulated with oil-impregnated paper, and they are grouped under the following headings: A general introduction to the subject; the technique of testing and examination; failure by the tracking mechanism; failure by thermal instability; d.c. and a.c. phenomena; mixed breakdowns and the problems of tracking; the formation and significance of voids; dielectric loss; barrier action; surface stress; and, finally, cable design.

The major portion of the book deals with cable failures and describes the various types encountered and the phenomena accompanying them. The studies embrace belted cables, H-type cables, oil-filled cables, and pressure cables, although the bulk of the experimental work referred to has been carried out on "solid" type cables in which the impregnation is done in the factory with a fairly viscous compound. Perhaps the outstanding chapters are those describing tracking, treeing, waxing, and void phenomena, and the photographic reproductions illustrating these are excellent. Of waxing, which has been very much to the fore of recent years, the author classifies no fewer than five different types, namely, void waxing, gap waxing, strand waxing, strand-space waxing, and bush waxing, each having its own well-defined characteristics, which make it easily recognisable.

The technique of the automatic thermocouple recorder developed by Dr. L. G. Brazier, a colleague of the author, through the medium of which examinations of "arrested failure" are possible, demands special recognition, as also does the magenta wax test devised by G. M. Hamilton.

It is evident from this book that a great deal of work yet remains to be done to determine the precise nature and characteristics of wax deposits in paper-insulated cables and other structures employing impregnated fibrous dielectrics, and it is, no doubt, not expecting too much to suppose that the author and his colleagues will be able to reach unassailable conclusions on this important matter in due course. In his foreword Mr. P. V. Hunter considers that this book will become one of the classics in the literature of the art of cable manufacture and that its influence will long be felt. We endorse this view completely.

Die Technik selbsttätiger Steuerungen und Anlagen. By G. MAINERS. Pp. 225; figs. 152. Munich: R. Oldenbourg. Price Rm. 12.50.

The increased use of automatic control gear in all kinds of electrical installations during recent years has necessitated the development of a special technology to deal with the problems of design and application. Simultaneously with the perfection of fully automatic equipment for unattended sub-stations and the like, there have been important developments in semi-automatic, remote control and protective interlocking gear, and the improvements in performance of all of these have been accompanied by simplifications in design and arrangement the importance of which is emphasised by the author. Not the least effect of technological advance in this field has been the virtual elimination of purely manual control, so that now almost every electrical installation makes more or less use of automatic interlocking, protective and actuating devices. The author shows how basic principles and types of apparatus can be applied to obtaining any desired degree of automatic operation, whether for increased safety, more rapid operation, simplified attendance, or a combination of these purposes.

The book is in two main parts dealing respectively with the problems, means and methods of automatic switching, and with typical applications of automatic control in power station and industrial service. Throughout, the illustrations and explanations are remarkably clear, and the author rightly attaches special importance to simplicity in lay-out and operation. These features, combined with the proper labelling of switching sequence diagrams, render automatic control easy to study and safe to apply. In his introductory remarks on the functions of automatic control and the relative scope of remote control and automatic operation, the author mentions that automatic working is increasingly a technical necessity in electrical installations, and its net effect on employment is probably beneficial, bearing in mind that automatic gear alone enables many small plants to remain in economic operation. The purpose and characteristics of all the principal types of relays, contactors and associated gear are fully explained, the application of automatic control to existing installations is discussed, and about one-third of the book is devoted to descriptions of typical applications. No part or aspect of the subject seems to have been left out of consideration.

Domestic Electricity. By T. A. MONCKTON. Pp. 82; figs. 6. London; Oxford University Press. Price: 3s. 6d.

This book's sub-title—"A book of simple, practical information to help the householder reduce bills and avoid accidents"—sufficiently describes its scope and its character. The electrical man's first reaction to a book on electricity addressed to the householder is deprecation. Is this one of those manuals which set out to persuade the "handyman" that after a reading of it he can lightheartedly undertake work to which an electrician has to bring the skill and experience of arduous years? In this case, however, a glance at the chapter headings is enough to dispel distrust.

Three chapters give "general information," a description of the "house supply," and useful hints on "how to cut down bills," the last alone being worth the cost of the book. Three other chapters deal with "precautions against accidents," "hints on radio supply, etc.," and "electric bells." The remaining three discuss the tracing and repairing of faults; and these are limited to faults in fittings and accessories. The author, in fact, says explicitly (p. 38): "You cannot, and indeed should not, do anything to the wiring in the house walls"; and more than once, elsewhere, he advises the calling in of a skilled electrician for anything beyond the simple, superficial repairs he lucidly describes.

In short, the book, pleasantly printed and bound, is one of the few of its type which can be safely commended to the layman, who will find it as interesting as it is informative.

Electrical Engineering Laboratory Manual—Measurements. By S. PARKER SMITH. Pp. 235; figs. London: Oxford University Press. Price: 5s.

This book contains practical directions for the carrying out of a large number of electrical tests which are comprised under the general designition of electrical measurements, and is based upon the laboratory routine of the Royal Technical College, Glasgow. The range of the tests dealt with covers resistance, inductance and capacitance measurements; instrument and meter testing; the investigation of d.c. and a.c. circuit charac-

teristics; the testing of materials and apparatus; photometry; and tests of thermionic tubes. The procedure for each test is concisely described and illustrated by an excellent diagram of connections, the manner in which the test results should be recorded is clearly indicated, and brief explanatory notes of a theoretical and practical character are added.

A preliminary section deals with the theory and practice of electrical measurements on general lines, and in this section one would have liked to have seen a slightly fuller outline of the theory of errors. In an appendix a model report is given showing the student exactly how he should record the results of his work, from the literary as well as from the technical point of view. The value of the work as a handbook of reference for the testing assistant would have been increased by the provision of an index. The book is clearly written, admirably illustrated, and can be recommended to test-room assistants as a profitable investment.

A First Electrical Book for Boys. By A. MORGAN and C. L. BOLTZ. Pp. 207; figs. London: G. G. Harrap & Co. Price: 5s. net.

To discuss and explain electrical phenomena to boys is a difficult matter and can only be done satisfactorily after considerable experience of the kind possessed by the authors of this volume, who are well known as writers of boys' books.

The early chapters are devoted to general observations on the nature of and relationship between electricity and magnetism and adequately cover the fundamental principles involved; they should be easily understood by the average schoolboy. The practical applications of electricity are discussed in a number of chapters with special reference to the transmission of speech, electro-chemistry and miscellaneous uses for X-ray work and commercial applications such as for the operation of clocks and lifts.

The book admirably satisfies the sort of curiosity attributed to the normal boy, but not necessarily possessed by him alone. To the authors of this volume the facts of nature are still interesting in themselves; they are not merely examples of theorems, and the entire subject is discussed in a most fascinating style.

The Cathode-ray Tube at Work. By J. F. Rider. Pp. 333; figs. 457. Manchester: Holiday & Hemmerdinger. Price 10s. 6d.

Technicians recognise in the electrical oscillograph the most versatile tool yet devised and one indispensable to meticulous research in a.c. fields.

The author of this book maintains that the cathode-ray tube is destined to become the most universally used testing device in radio and electrical work; and while this tube is limited in many respects compared with the three-loop projecting oscillograph—to cite one modern example—it has much advantage to offer in convenience, compact portability, adaptability and cost. In the hands of trained users the cathode-ray tube can be used in servicing sensitive and complex electrical circuits as can no other single piece of apparatus.

The book deals in detail with tubes of American manufacture, but many are similar in type and operation to those made and available in this country, although at present employed by very few for the routine uses here outlined. However, wide use is likely to follow in course of time, and this book is one of the first to describe in detail the arrangement of circuits, the setting up of the tube, its practical applications and an analysis of a large number of wave forms and complex patterns likely to be produced in practice. The author makes it clear that the cathode-ray tube is not confined to the laboratory class but is now a capable instrument of wide practical utility.

This work should be of value primarily for radio servicing as a reference book of practical applications and methods of operation. The descriptive text is clear, but in many instances could, with advantage, be more concise. The illustrations and photographs are good and diagrams of circuits are given.

* * *

Shorter Notices

"Death in Diamonds." By H. R. Taunton. (Pp. 288.) London: Hurst & Blackett. Price 7s. 6d. net.—Those of our readers who studied Mr. Taunton's masterly exposition of the I.E.E. Wiring Regulations will have no doubt of his qualifications for authorship of a mystery story. This is not his first effort in this direction, and he reaches a very high standard. The ingredients, while orthodox, are mixed into an ingeniously constructed plot in a readable style. It is not hard to detect the hand of an electrical man in the book—for instance, one of the characters is "Ginger Wire" *alias* "Joseph Cable," while an accurate description of a closed-circuit burglar alarm is given.

"Electricity and Magnetism for Engineering Students," by A. W. Hirst. Pp. 388; figs. London: Blackie & Son, Ltd. Price 15s. net.

"A Universal Stress Sag Chart," by J. T. Hattingh. Pp. 74; figs. and tables. London: Blackie & Son, Ltd. Price 12s. 6d. net.

"An Introduction to Neon Lighting," by J. Orr and A. W. Forrest. Pp. 80; figs. 37. London: Blackie & Son. Price 3s. 6d. net.

"The Protection of Electric Plant," by P. F. Stritzl. Pp. 200; figs. 153. London: Sir Isaac Pitman & Sons. Price 18s. net.

"A First Electrical Book for Boys," by A. Morgan and C. L. Roltz. Pp. 207; figs. London: G. G. Harrap & Co. Price 5s. net.

"Der Erdschluss in Hochspannungsnetzen," by H. Weber. Pp. 107; figs. 86. Berlin: Verlag von R. Oldenbourg. Price: Rm. 5.80.

"Der Wert der Wärmeersparnis," by Dr.-Ing. Franz zur Nedden. Pp. 163; figs. Berlin: Verlag von R. Oldenbourg. Price Rm. 8.

"Mercury Arcs," by F. J. Teago and J. F. Gill. Pp. 104; figs. 49. London: Methuen & Co. Price: 3s. net.

New Zealand's Electrical Imports

THE recovery which set in during 1934 in the electrical import trade of New Zealand continued in 1935, as will be seen from the following figures extracted from the official returns. The preliminary statistics that are available for the first half of the current year show further progress, imports of electrical machinery and equipment totalling about one-third more in value during that period than during the corresponding period of 1935.

The big Government housing scheme, on which £3,500,000 is to be spent during the next twelve months, gives promise of an increased demand for wiring, fittings and certain household appliances. The Hydro-Electric Branch of the Public Works Dept. has been allotted a sum of £500,000 in this year's Budget.

In the subjoined statement of last year's imports it will be noticed that a more detailed classification than formerly has been adopted, and consequently comparable figures are not available for a number of the classes set out. Where it is possible the increases or decreases compared with 1934 are given.

	1935 £ (000).	Inc. or dec. on 1934 £ (000).
Storage batteries and parts—		
Total	98	*
From United Kingdom	24	*
„ Canada	16	*
„ Australia	52	*
Other batteries and cells—		
Total	49	*
From United Kingdom	18	*
„ Canada	20	*
„ Australia	4	*
Carbons or electrodes for arc lamps or for electric welding—		
Total	28	*
From United Kingdom	11	*
„ Australia	13	*
Insulated cable and wire—		
Total	204	+ 58
From United Kingdom	189	+ 52
„ Holland	3	+ 1
„ United States	6	+ 4
Insulators—		
Total	28	+ 2
From United Kingdom	15	− 6
„ Canada	5	+ 3
Filament lamps—		
Total	157	+ 12
From United Kingdom	143	+ 9
„ Holland	2	− 1
„ United States	12	+ 6

	1935 £ (000).	Inc. or dec. on 1934 £ (000).
Other electric lamps—		
Total	30	+ 12
From United Kingdom	11	+ 4
„ Germany	3	+ 1
„ Japan	6	+ 1
Electric ranges—		
Total	53	+ 32
From United Kingdom	40	+ 25
„ Canada	12	+ 6
Wireless receiving sets mounted in cabinets—		
Total	81	*
From United Kingdom	11	*
„ Canada	8	*
„ United States	45	*
„ Australia	10	*
Wireless receiving sets built up but not mounted in cabinets—		
Total	61	*
From Canada	4	*
„ United States	56	*
Wireless valves—		
Total	69	*
From United Kingdom	18	*
„ Holland	12	*
„ United States	39	*
Other wireless apparatus—		
Total	109	*
From United Kingdom	18	*
„ Holland	1	*
„ United States	50	*
„ Australia	36	*

	1935 £ (000).	Inc. or dec. on 1934 £ (000).
Other telegraph and telephone apparatus—		
Total	75	+ 50
From United Kingdom	67	+ 49
„ United States	4	− 1
„ Australia	1	—
Other electrical apparatus (duty free if British)—		
Total	364	+ 113
From United Kingdom	251	+ 85
„ Canada	7	—
„ Germany	9	+ 2
„ Sweden	12	+ 6
„ United States	55	+ 14
„ Australia	22	+ 4
Other electrical apparatus (dutiable)—		
Total	85	+ 18
From United Kingdom	52	+ 9
„ Germany	1	—
„ Canada	4	—
„ United States	9	+ 4
„ Japan	3	+ 1
„ Australia	16	+ 5
Motors—		52
Total	125	+ 15
From United Kingdom	61	+
„ Germany	1	—
„ United States	43	+ 25
„ Canada	9	+ 6
„ Sweden	7	+ 4

* Comparable figures not available for 1934.

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

The Bethnal Green Case

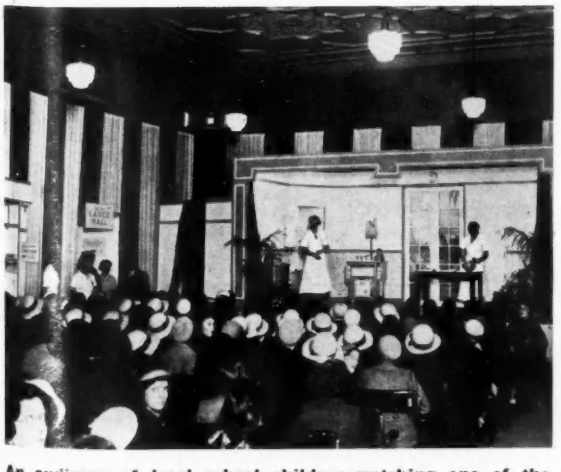
At its last week's meeting the Bethnal Green Borough Council considered and adopted a report by the Law and General Purposes Committee upon the recent prosecution of a councillor and another man for attempted bribery (Elec. Rev., Sept. 18th, p. 382). In the course of its report the Committee states that throughout the proceedings the methods of the Council with reference to tenders, contracts or other matters were never in question, and it is claimed that the Council's system is highly efficient and that immediately there were sufficient grounds for action the Council took the appropriate steps. The bona fides of the Harland Enginering Co., Ltd., were never in question and the Committee says that it has "no hesitation in recording that these contractors have throughout acted under instructions from higher authorities and from a sense of public duty."

Key Industry Duty

The Board of Trade has received an application under Section 5 (5) of the Finance Act, 1936, for a licence to import free of duty an X-ray apparatus (excluding X-ray tube) of the type known as Lysholm apparatus for cranial radiography. Any representations that similar apparatus is made or is likely to be made within a reasonable time in the United Kingdom or elsewhere in the Dominions should be addressed to the principal assistant secretary, Industries and Manufactures Department, Board of Trade, Great George Street, S.W.1, before October 15th.

Croydon Electric Home Exhibition

Indications of the steady progress made by the Corporation Electricity Department were given by the Mayor, Alderman A. Peters, at the opening of the Electric Home Exhibition at the Public Halls, Croydon, on September 23rd. There were now, he said, 53,000 electricity consumers in Croydon, and, while the capacity of the electricity works in 1896 was just under 500 kW, to-day it amounted to 58,000 kW; extensions in hand would soon bring this figure up to 90,000 kW. Recently the Croydon Electric Circle, consisting of contractors and others engaged in the electrical industry, had been formed to promote co-operative relationship with the supply authorities, while a local branch of the Electrical Association for Women had already over a hundred members. In conclusion, the Mayor congratulated the Electricity Committee, the borough electrical engineer and manager (Mr. F. N. Rendell-Baker) and his staff on the success of the undertaking and also on the attractiveness of the exhibition. Mr. E. Lester Boddington, chairman of the Electricity Committee, said that of the 12,000 people who attended the previous exhibition two years ago 80 per cent. were potential customers and 450 signed agreements. Furthermore, no fewer than 3,800 installations were carried out under the assisted-wiring scheme alone as a direct or indirect result of the exhibition. Demonstrations of water heating and refrigeration equipment occupy most of the centre of the main hall, while round the walls are stands arranged by Messrs. Belling & Co., Ltd.; Berry's Electric, Ltd.; British Vacuum Cleaner & Engineering Co., Ltd.; Bulpitt & Sons, Ltd.; Croydon Electric Circle; General Electric Co., Ltd.; L. G. Hawkins & Co., Ltd.; Hotpoint Electric Appliance Co, Ltd.; Hurley Machine Co. (England), Ltd.; Revo Electric Co., Ltd.; and Simplex Electric Co., Ltd. The hall lighting fittings have been supplied by Messrs. L. G. Hawkins & Co., Ltd., G.E.C. architectural lamps being used for decorative purposes. Until to-morrow, when the exhibition closes, frequent demonstrations of electric cooking and washing will be given, together with talking pictures, in a separate demonstration theatre in which are also to be found a model kitchen, E.A.W. and cooker inquiry bureaux, an E.L.M.A. lamp display, a greenhouse showing G.E.C. soil-heating equipment, and various types of cookers. Microphone-amplifying equipment has been installed by Messrs. Philips Industrial, the portable talking-picture apparatus being supplied by the Western Electric Co., Ltd. Ozonair, Ltd., are responsible for air-purifying apparatus.



An audience of local school children watching one of the demonstrations at the Croydon Electric Home Exhibition

New Met.-Vick. Manchester Premises

The Manchester office of the Lamp Sales Department of the Metropolitan-Vickers Electrical Co., Ltd., has been transferred to larger and better equipped premises at 20, Mount Street, Manchester. The new offices are close to the Central Station and also to the new civic centre. The equipment of the premises provides greatly improved facilities, both for large stocks and speedy service. There is a covered-in loading-way for vehicles. In addition to lamps, stocks are carried of "Metrovick" electrodes which are sold through this department as well as through the company's Welding Department.

The trade counter of the new Manchester office of the Met.-Vick. Lamp Sales Department

Wages in the Cable-making Industry

The Joint Industrial Council for the Electrical Cable Making Industry announces that there will be no cost-of-living alteration in wages on the third pay day in October.

German Electrical Imports and Exports

According to official figures published in *E.T.Z.*, the exports of electrical machinery, apparatus and cognate material from Germany during the six months ended with June last attained a value, converting Reichmarks at 12.5 to the £, of no less than £9,366,480, as compared with only £8,404,328 in the corresponding half of 1935. On the other hand, the imports of similar material into Germany during the same period declined from £865,600 to £681,680.

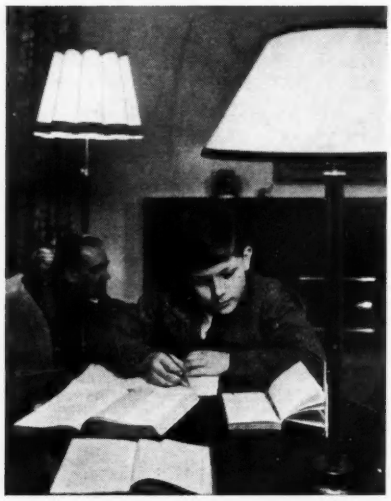
The Kettering Radio Exhibition

The fourth annual radio exhibition of the Kettering Radio and Physical Society was opened on September 24th by Mr. W. A. Walker, A.M.I.E.E., engineer and manager of the Kettering U.D.C. Electricity Department. The exhibition was held at the Central Hall, Kettering, and practically every local radio and electrical dealer had a stand, a wide range of radio receivers being exhibited. There were demonstrations of bloodless surgical operations by Dr. Lemon, F.Ph.Soc., A.M.I.R.E.; X-ray apparatus in operation; a radio robot which read, spoke, moved and answered questions; and continuous cinema shows. A major attraction was a £5,000 telephoto apparatus used for the transmission of photographs by wireless for newspaper reproduction.

Better Light—Better Sight

To inaugurate the "Better Light—Better Sight" campaign, which is being launched by the Joint Council of Qualified Opticians, the British Electrical Development Association and the Electric Lamp Manufacturers' Association Lighting Service Bureau, an exhibition of lighting through the ages was held at the Lighting Service Bureau, 2, Savoy Hill, London, W.C.2, on September 24th. The exhibition included a Romano-Egyptian lamp (about 44 B.C.), an early Roman vegetable oil lamp,

a Venetian stand lamp and a Flemish 17th century oil lamp. Then came the age of candles, with the rush candle holder and horn lantern, with the stand illustrative of the following era of oil lamps in 1800. Gas was next used, being introduced about 1830. A stand of modern electric lighting equipment included the coiled-coil lamp, and there was a light sight tester which enabled the operator to find out the exact illumination required for comfortable reading. At the opening Mr. A. C. Cramb said that the exhibition showed in some measure the great advances that had been made in the science of lighting. Standards of lighting intensity had been drawn up by the Lighting Service Bureau, the electricians and the Electrical Development Association. If these were adhered to it was not too much to say that many not only optical but also physical ills would disappear. In the matter of domestic electrical appliances we were more advanced than any other country in Europe. It was now for Britain to take the lead in, perhaps, the most important electrical appliances of all. Better sight could be assured by better light, and if the campaign by the opticians and the electrical industry could do anything to make life easier for workers in the home and office then it would have achieved its aim. Mr. W. J. Jones said that the campaign to be inaugurated this autumn marked in a significant way the co-operation which now existed between the lighting industry and the optician. Both were out to save the nation's eyes. The speed of living was bound to increase, and with it, the strain on eyesight. In this country alone large sums were being spent every year on electric lighting research, and now both departments of research—the E.L.M.A. Lighting Service Bureau and the opticians—were co-operating more closely than they had ever done before. Major W. H. Champness, chairman of the Joint Council of Qualified Opticians, pointed out that one-third of the population of England had to wear glasses, which provided evidence partly of the wear and tear of modern conditions and partly of the carelessness of the individual in respect of his eyes. Opticians and electricians had come together to see what could be done about it. The buying of poor quality lamps and the installation of insufficient fittings in the home was false economy, but the public did not appear to realise it. To help them to do so, the optical profession had joined forces with the electrical industry.



A scene from the "Better Light—Better Sight" film

A Belgian Electrical Association

With the title of Les Interets Corporatifs des Grossites en Materiel Electrique (I.C.G.M.E.), Union Professionnelle, a new association has lately been organised in Brussels to protect the interests of wholesalers of electrical material throughout Belgium.

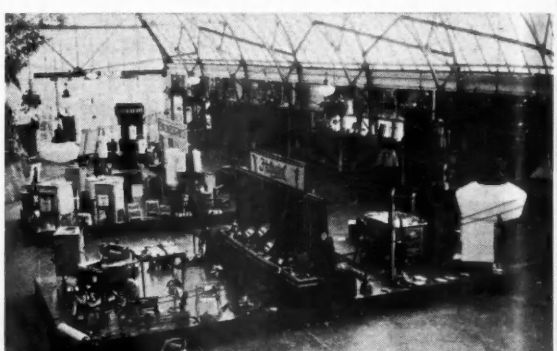
Trolley-buses for Manchester

Contracts totalling £100,000 have been placed by the Manchester Corporation Transport Department for forty-three trolley-buses. The orders for the vehicles have been placed with Leyland Motors and Crossley Motors, and all the electrical equipment will be manufactured by the Metropolitan-Vickers Electrical Co., Ltd.

The Harwich Electrical Exhibition

Mr. Stanley Holmes, M.P. for the Harwich Division, officially opened a large exhibition, organised by the Harwich Corporation (electrical engineer, Mr. J. H. Shepherd), in the Cliff Pavilion, Dovercourt, on September 21st. There was a big gathering at the opening ceremony, and Mr. T. H. Bernard, chairman of the Electricity Committee, acknowledged the co-operation of manufacturers and complimented the local retailers on their enterprise. Mr. Stanley Holmes said that the electricity undertaking had doubled the sales of electricity in the last five years, and the price during that period had been reduced by 33 per cent. Demonstrations of the apparatus and of cookery by electricity were given each afternoon and evening during the week.

The exhibitors included Carron Company; the General Electric Co., Ltd.; the Hotpoint Electric Appliance Co., Ltd.; the English Electric Co., Ltd.; the Simplex Electric Co., Ltd.; Bulpitt & Sons; Heatrae, Ltd.; Hoover, Ltd.; Burnley Components, Ltd.; L. G. Hawkins & Co., Ltd.; H. G. Tumilty; J. A. Saunders, Ltd.; H. D. & P. Co-operative Society; and the Harwich Corporation Electricity Department.



A general view of the Harwich Electrical Exhibition

Lyons's New Brasserie

The design and equipment of Messrs. Lyons's new brasserie in Coventry Street, W.1, opened last week, provide a remarkably gay and cosmopolitan effect. To preserve an "intimate" atmosphere it has been arranged on two levels, the higher one surrounded by a balustrade representing a terrace overlooking a courtyard. The false floor put in to gain this higher level has been utilised in connection with the air-conditioning installation (Carrier), fresh air being introduced through slots in the frieze round the room and withdrawn at the foot of the walls. The eaves along the wall face of the courtyard are outlined with tubular lamps, and the Oriental effect produced is enhanced by the extensive use of copper for the lighting fittings, the metal trimmings to the teak woodwork and the frames of the decorative windows, which are inset in the false wall and are illuminated by means of tinted lamps. Most of the room is lighted by lamps fitted inside pink-tinted glass cones supported on large umbrella standards, with additional semi-indirect lighting fittings at each of the four corners. Similar glass cones, mounted either singly or in pairs, in ultra-modern combinations of copper hoops, suspended from the ceiling, illuminate the remainder of the brasserie. Under the roof of the bandstand and buffet are concealed reflectors, while the illuminated signs and notices are made of metal stencils lighted from the back. Altogether the lighting load is about 25 kWh. Loud speakers (supplied by Messrs. Alexander Black, Ltd.) are concealed behind cymbal-shaped metal ornaments in the ceiling. Electrical equipment in the kitchens includes automatic washing machines, potato peelers, mixers, whisks and waffle machines. The whole of the reconstruction work was carried out under the superintendence of the Building, Engineering and Electrical Departments of Messrs. J. Lyons & Co., Ltd., the electrical fittings, aluminium tiling and decorations being manufactured and installed by Evenlite Tube Developments, Ltd.

The new brasserie in Coventry Street, London, W.

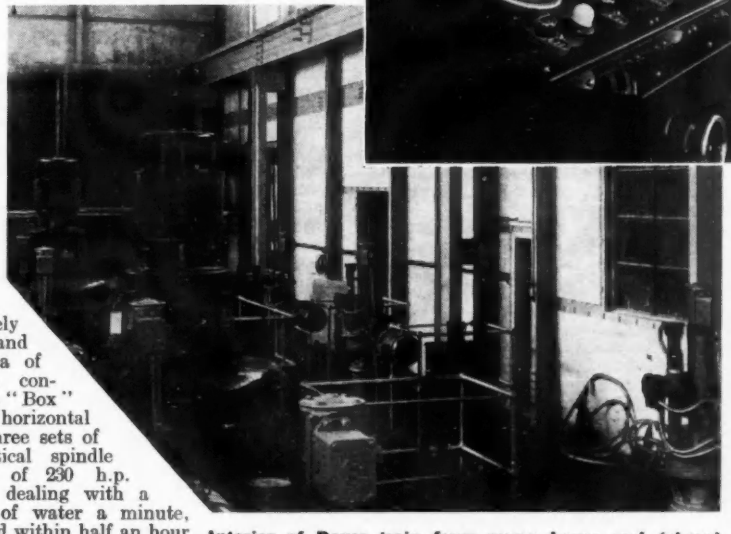
A College Electrical Installation

Comprehensive electrical work proceeding at Malvern Boys' College includes the wiring at the east end of the chapel, the memorial library and the new science block of three storeys. In the chapel, a striking effect has been obtained by the combination of floodlighting and architectural lighting tubes. The wiring was erected neatly on the surface of the stone walls, the Henley system being used. The rewiring of the detached building of the memorial library was carried out with "Superite" cables, which have been drawn into the existing conduits. These cables were used as the installation in the past has suffered from condensation in the conduits, and in some places from the effects of heat from the central heating pipes. The wiring of the new science block, building work on which is now proceeding, embraces approximately 230 lighting points, with twenty-four lighting and seventeen power plugs. Henley's class "W" cable will be drawn into screwed conduit. Messrs. Abell & Smith's Electrical Co., of Worcester and Malvern, who are responsible for the wiring work, are also carrying out wiring work in other portions of the college buildings, such as the motor and control gear for a new filtration plant for the baths, new stage lighting equipment in the gymnasium hall, and a new system of lighting in some of the classrooms. The wiring throughout all the buildings is carried out with screwed steel and galvanised conduits and Henley cables, to the instructions of the college architects, and under the supervision of the estate steward, Mr. Brebber.

Floodlighting in the hop country: This attractive picture shows the oast houses at Messrs. Whitbread's hop farm in Kent, which is illuminated by eight 500-W G.E.C. floodlights at ground level. Some of the buildings are 60 ft. high and are visible from a considerable distance. Power comes from the 100-V d.c. generating set belonging to the farm

Cross-Channel Train Ferry

On October 14th the first passenger train ferry service to the Continent is being inaugurated between Victoria and Paris *via* Dover and Dunkerque. As the waters of England and France on either side of the Channel have a daily rise and fall of as much as 25 ft. an inclined slip such as is used for many road vehicle ferries was out of the question owing to the necessity of having a suitable gradient. Consequently, a system of locks enabling the vessels to link up with the shores whatever the state of the tides has been adopted. Locks were already in existence at Dunkerque, but at Dover a completely new dock 405 ft. long and 72 ft. wide with an area of 30,000 sq. ft. has been constructed. Two gates of the "Box" type, which work on horizontal keels are provided, and three sets of electrically operated vertical spindle centrifugal pumps, each of 230 h.p. capacity and capable of dealing with a maximum of 120,000 gals. of water a minute, enable a ferry to be berthed within half an hour under the most unfavourable conditions. In order to secure maximum efficiency the pump chamber, which measures 102 ft. by 40 ft., is situated 50 ft. below high water level. The upper portion of the pump house provides accommodation for the pump motors, the whole of the electrical gear controlling the operation of the main and auxiliary pumps, the valves and the special electric generators supplying the motors for the dock gate winches. Other electrical equipment includes an articulated lifting bridge, 70 ft. long, and wide enough to accommodate two railway trucks. The passage of all traffic will be controlled by a complete electrical signalling and interlocking installation, so as to eliminate any possibility of a mishap occurring. Each of the three vessels used can carry twelve carriages or forty loaded goods wagons, and there is a garage for 25 cars on the upper decks.



Interior of Dover train ferry pump house and (above) pump control panel

Increased London Gas Charges

The decision of the South Metropolitan Gas Co. to institute a three-part sliding-scale tariff in place of its present flat rate system of charging continues to call forth adverse criticism. The London County Council and the metropolitan borough councils whose areas are affected have made protests to the company, which, however, has announced its intention of adhering to its decision. It points out that for some time past the smaller consumers have been served at a loss to the company, and the new tariff, which is designed to encourage increased consumption of gas, is essential to the company's welfare. Representations have been made to the Board of Trade which now has the matter under consideration.

Works Visit

The Midland Branch of the Association of Mining Electrical Engineers visited the works of the Brush Electrical Engineering Co., Ltd., on September 17th. The visitors were taken through the Turbine, Electrical, Transformer, Diesel, Coach and Bus Body Building and other departments, and on completion of the tour they were entertained to tea at the King's Head Hotel.

The "Cosmos" Calendar

Once again the Metropolitan-Vickers Electrical Co., Ltd., has chosen an attractive blonde for its calendar. In the 1936-37 edition the subject is painted by the artist who created last year's production, and each daily slip contains a quotation.

For Sale

Manchester Electricity Department has for sale turbo-generators and boilers.

(See our classified advertisements.)

Electrical Development in East Anglia

We have received from Mr. G. L. Garton, hon. secretary of the Advertising Section of the Ipswich and District Electrical Association, a brochure entitled "Electricity Service in East Anglia," 30,000 copies of which are being distributed to consumers and prospective consumers in East Anglia. This Association, which was founded four years ago by Mr. H. E. Blackiston (chief engineer and manager of the Ipswich Electricity Supply and Transport Departments), includes electricity supply and distribution authorities, leading electrical contractors, electrical manufacturers and factors in East Anglia, and its objects are to show consumers in the area how they can get the best and most economical results from their electricity supply. The present membership is fifty-four. The brochure now being circulated explains in simple terms what electricity can do and the advantages of employing electrical appliances in the home.

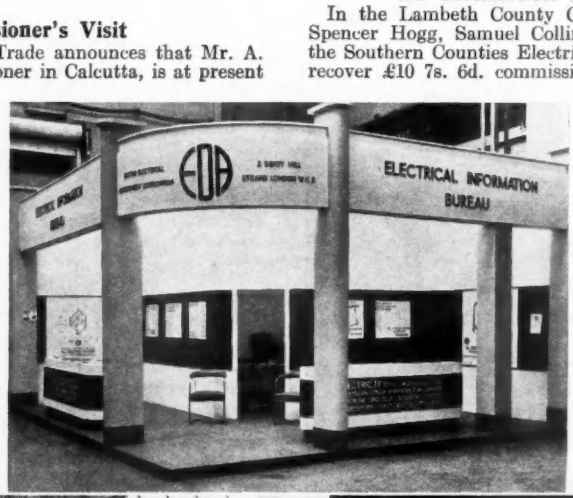
Price Increase

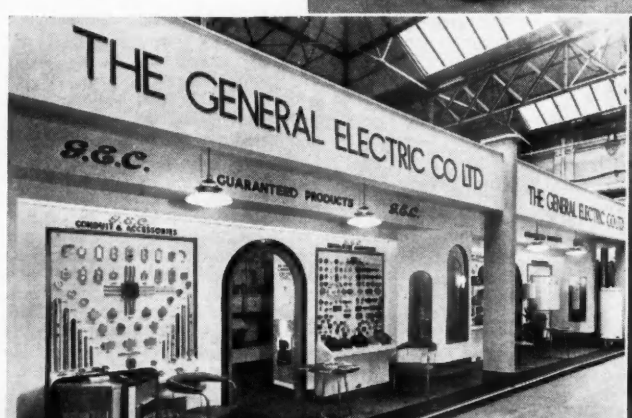
Messrs. Dorman & Smith, Ltd., inform us that owing to continued increases in engineering wages and advances in raw material costs they have increased all their list prices by a

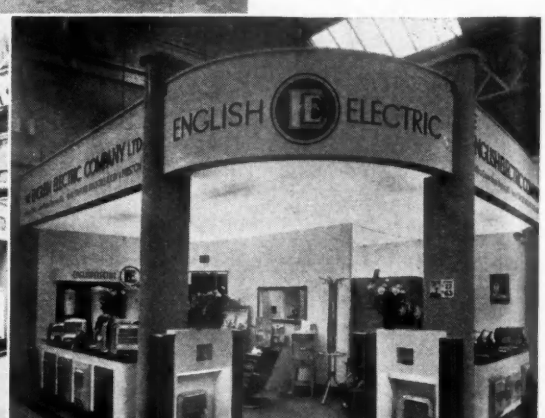
further 5 per cent. Orders received up to and including September 30th will be entered (as at present) at list prices, plus 5 per cent. Those received after that date will be accepted at list prices plus 10 per cent.

Trade Commissioner's Visit

The Department of Overseas Trade announces that Mr. A. Schofield, H.M. Trade Commissioner in Calcutta, is at present in the United Kingdom on an official visit. Mr. Schofield will be available at the Department of Overseas Trade during the period October 15th to 23rd for the purpose of interviewing manufacturers and merchants interested in the export of United Kingdom goods to Eastern and Southern India, Burma and Ceylon, after which he will visit a number of industrial centres in the provinces. Firms desiring an interview with Mr. Schofield in London or information regarding his arrangements to visit provincial centres should apply to the Department, 35, Old Queen Street, London, S.W.1, quoting reference 19400/36.







Three of the electrical stands at the Building Exhibition, Olympia, showing the E.D.A. information bureau (top), and the displays of the General Electric Co., Ltd. (left), and the English Electric Co., Ltd.

The North London Exhibition

The eleventh annual Home Lovers' Exhibition will open at the Alexandra Palace, N., on October 7th. From the electrical point of view the chief attraction will be the "Northmet" electrical pavilion which will occupy the whole of the south-west corridor. Here the manifold uses of electricity in the home will be demonstrated, and there will be a wide range of electrical domestic appliances on view.

The B.E.A.M.A. Dinner

The Lord Chief Justice (Lord Hewart) will be the guest of honour at the annual dinner of the British Electrical and Allied Manufacturers' Association, to be held on November 17th at Grosvenor House, Park Lane, W.

Orders Recently Booked

The Chloride Electrical Storage Co., Ltd., has in hand to the order of Messrs. Crompton Parkinson, a battery of 113 Chloride cells in lead-lined wooden boxes, capacity 1,600 Ah in 10 hr., for the Fulham Borough Council for use for the emergency lighting of the Earl's Court Exhibition building. The battery will operate on the floating battery system, and will be capable of supplying a load of approximately 192 kW for one hour in a 240-V circuit. The Chloride Electrical Storage Co., Ltd., has also supplied a battery of 110 Chloride cells in glass boxes, capacity 272 Ah in 10 hr. for the emergency lighting equipment of the Empress Hall, which is the first portion of the Exhibition building to be completed. This battery, which was installed by Messrs. T. Clarke & Co., Ltd., also operates in a floating battery system, and is capable of supplying a load of approximately 15 kW for a period of about three hours.

Messrs. C. A. Parsons & Co., Ltd., have recently received an order for two large high-voltage turbo-generators complete with condensing plant for the Mulajore power station of the Calcutta Electric Supply Corporation, Ltd. Each of the sets will have a continuous capacity of 30,000 kW at 3,000 r.p.m., and will operate with steam at 350 lb. superheated to 700 deg. F. The alternators will be of the Parsons concentric conductor type and will generate current directly at 33,000 to 36,000 V.

An Installation Commission Dispute

In the Lambeth County Court last week before Judge Spencer Hogg, Samuel Collins, a canvasser, Peckham, sued the Southern Counties Electrical Installations, of Peckham, to recover £10 7s. 6d. commission alleged to be due for orders obtained for the installation of electricity at various houses, when the plaintiff was in the defendants' employ. The defendants alleged that the plaintiff had gone round to customers, and in order to induce them to do business had asserted that he came from the South London Electric Supply Corporation or the County of London Electric Supply Co.

They also alleged that he had been paid moneys that he had not given credit for, and that in some cases he was asking for commission that was not due, as the cables had not been laid.

The plaintiff said that he was employed on a commission basis; he was to get 10 per cent. on all orders he obtained for the installation of electricity on the hire-purchase system and 15 per cent. if it was for cash. He had supplied a list in his claim of the orders he had obtained for which he had not been paid. He had now left the defendants' employ. In cross-examination he denied that he ever gave the name of either of the two companies mentioned in the defence, nor had he ever been cautioned not to do so. He always left the firm's card with the customer, besides which every customer had to sign an order form, and could see who he was dealing with.

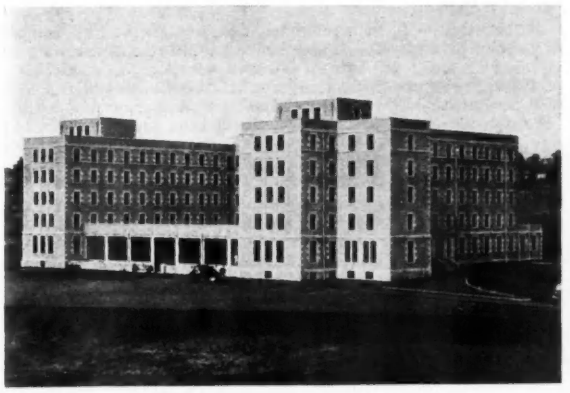
A witness for the defence said she thought she was dealing with the County of London Co., so when a query arose they were written to, and she then found out the mistake. She agreed that the plaintiff left his card on the table, but she thought it was the County of London Electric Supply Company's.

The manager of the defendant company said that the commission was only payable as to 50 per cent. if the cables were outside the door. He had gone into the account very closely, and really plaintiff had been overpaid. Judge Spencer Hogg said that if there had been no charge of dishonesty the case would have been a very trivial one. He was not satisfied that the allegations had been proved. After going through the mass of intricate figures, the best decision he could come to was in favour of the plaintiff for £3 17s. 6d., and costs. On an application by the solicitor for the plaintiff he allowed a special fee for his advocate.

The Aberdeen Royal Infirmary

The new Aberdeen Royal Infirmary, which was opened by H.R.H. the Duke of York on September 23rd, has been erected at a cost of over £400,000. The new buildings have accommodation for 500 patients in three separate ward blocks and are equipped on the most modern principles. Each ward block is served by electric passenger lifts and, with the exception of the medical block, which has radiators, heating is by means of panels concealed in the ceiling. Each bed has been wired for electric light, X-rays and wireless. There are 258 wireless

points in the surgical block, for the whole of the electrical installation of which Messrs. Lowdon Bros., Ltd., Temple Electric Works, Dundee, were responsible. These contractors also carried out the complete electrical equipment of the nurses' home, the special block, post-mortem block, and the porter's lodge. In the surgical block they installed over 800 lighting points, 183 5-A lighting sockets, 65 15-A power sockets and four lift cables. In the nurses' home 875 lighting points



The Aberdeen Royal Infirmary in which Henley wires and cables have been extensively used

were installed, with sixteen 5-A lighting sockets, twenty-three 15-A power sockets and two lift cables. The special block required 568 lighting points, ninety 5-A sockets and seventy-three 15-A power sockets. In this block the contractors also installed three special 30-A points with 7/.052 cable to each; the wiring between special distribution boards; three main switchboards for light and three for power; special main switchboard for X-ray apparatus in three rooms controlled by 300-A circuit-breaker with armoured 37/.103 mains. Henley cables were used throughout for the blocks mentioned. The maternity hospital, which is built on the same site, is being wired with Henley cables by Messrs. J. F. Anderson, Ltd., Aberdeen. The twenty-two standard lamps in the main avenue were also wired with Henley cables. The architect was Mr. J. B. Nichol, and the clerk of works for the electrical installation was Mr. J. Jackson.

Prices of Materials

Messrs. Henry Gardner & Co., Ltd., report, September 30th: No change in the price of copper bars (best selected), sheet and rod. English pig lead, £20, 10s. dec. Spelter, £13 17s. 6d., 3s. 9d. dec. English block tin, £200 10s., £2 10s. inc.

Messrs. Frederick Smith & Co. report, September 30th: Electrolytic copper bars, £44 10s., £1 inc. Ditto, ditto, wire rods, £50, £1 inc. Ditto, ditto, h.c. wire, 7½d., ¼d. dec. Silicium bronze wire, 8½d., ¼d. dec.

Messrs. Edward Till & Co. report, September 30th: No change in the price of India rubber, Para fine.

Trade Announcements

The Universal Lighting Co., electrical engineers and contractors, has opened larger premises at the corner of High Street and Station Road, Clacton-on-Sea.

Power Lines Construction Co., Ltd., has removed to 32, Victoria Street, Westminster, S.W.1 (telephone: Victoria 9706).

Davis Bros., Illuminating Engineers, Ltd., have removed to 22, Buckingham Street, Strand, W.C. (telephone: Temple 5285).

The Phosphor Bronze Co., Ltd., has removed its London office to 54, St. Thomas's Street, Borough, S.E.1 (telephones: Hop 0703/4/5).

New Catalogues and Lists

Eversheds & Vignoles, Ltd., Acton Lane Works, London, W.4.—A leaflet introducing "Megger" testing instruments.

Electro-Dynamic Construction Co., Ltd., St. Mary Cray, Kent.—A catalogue of power equipment for radio, public address systems, car radio, &c.

M.K. Electric, Ltd., Wakefield Street, Edmonton, London.—Showcards for M.K. safety sockets and two-way safety adaptors.

British Insulated Cables, Ltd., Prescot, Lancs.—A leaflet dealing with enamelled wire with adhesive paper covering.

Poles, Ltd., 3/4, London Wall Avenue, London, E.C.2.—A catalogue of "Adastra" standards.

Wardle Engineering Co., Ltd., Old Trafford, Manchester.—An illustrated pamphlet dealing with the new sodium lighting at Purley Way.

Time Switches & Instruments, Ltd., 120, Victoria Street, London, S.W.1.—A catalogue of time-switches for all purposes.

E. Shipton & Co., Ltd., 12/15, Dartmouth Street, London, S.W.1.—A booklet describing the "Textophone."

L. G. Hawkins & Co., Ltd., 30/35, Drury Lane, Kingsway, London, W.C.2.—A new catalogue of domestic products, and leaflets dealing with the "Tecal" and "Sunray-Tricity" fires.

Switchgear & Cowans, Ltd., Elsinore Road, Old Trafford, Manchester, 16.—An illustrated art booklet on internal isolation switchgear. A new method of lay-out and improved typography are employed.

Electromagnets, Ltd., 48, High Street, Erdington, Birmingham.—A folder dealing with "Boxmag" electromagnetic equipment.

Gent & Co., Ltd., Faraday Works, Leicester.—A booklet dealing with the "Pul-syn-etic" system of electric turret and bracket clocks, and a folder on "Tangent" bells, hooters, and sound signals.

H. Morris, Ltd., Loughborough.—Details of a new elevating truck and a stacker.

International Combustion, Ltd., Aldwych House, Aldwych, London, W.C.2.—A revised catalogue of Hummer screens.

Bankruptcy Proceedings

F. H. Villiers (trading as Vacuum Cleaner & Electrical Appliance Co.), 72, Park Hill, Clapham, S.W.4, electrical engineer.—The first meeting of creditors in this matter was held at 29, Russell Square, London, W.C.1, on September 21st. According to the statement of affairs prepared by debtor there were ranking liabilities of £651, with net assets of £58, leaving a deficiency of £594. Debtor attributed his failure to insufficient profits to cover the drawings of his partners and himself; taking over an insolvent business, and agreeing to return to one partner the capital introduced by him. The case being a summary one was left in the hands of the Official Receiver, as trustee.

F. W. Albinson, 73, Stanton Road, Sandiacre, formerly electrical engineer.—Decline in turnover owing to the introduction of an assisted wiring scheme in the district, and keen competition, were stated to be the causes of this debtor's attendance at the Official Receiver's office, 22, Regent Street, Park Row, Nottingham, for his first meeting of creditors on September 25th. His statement of affairs disclosed a deficiency of £114. The case was left in the hands of the Official Receiver, as trustee.

P. T. Bradley, 1, The Arcade, Stafford, and 10, Church Lane, Stafford, radio engineer.—The public examination herein was held on September 23rd at the Shire Hall, Stafford, when the Registrar remarked that apparently the debtor had been the "victim of circumstances." Debtor attributed his failure to the high rent he had to pay, and other overhead expenses. His gross liabilities amounted to £1,138, of which £582 was expected to rank for dividend. The assets were estimated to realise £154, and there was a deficiency of £428. The Registrar closed the examination.

S. Allen, 43, Fossgate, York, electrical engineer.—This debtor appeared for his public examination on September 24th at the Law Courts, York. His statement of affairs disclosed gross liabilities of £1,323, of which £579 was expected to rank, and net assets of £37, leaving a deficiency of £542. Debtor attributed his failure to heavy costs of litigation and losses on contracts. The examination was adjourned.

C. W. Prosser, trading as Prosser Brothers, 81, Woodside Street, Cinderford, Glos, electrical engineer.—This debtor appeared for his public examination recently at the Shire Hall, Gloucester. According to the statement of affairs there were gross liabilities of £244 and estimated assets of £28. The failure was attributed to ill-health, lack of capital, keen competition and local depression. The examination was concluded.

C. B. Allsop (C. B. Allsop & Co.), radio wholesaler, 69, Great Hampton Street, Birmingham.—Receiving order made September 22nd on debtor's own petition. First meeting October 7th at 159, Great Charles Street, Birmingham. Public examination October 21st at the Court House, Birmingham.

T. B. Brown (Brown & Senior), wireless and electrical engineer, 199, Slaithwaite Road, Dewsbury.—Receiving order made September 19th on debtor's own petition. First meeting October 2nd at 71, Manningham Lane, Bradford. Public examination November 5th at the Court House, Dewsbury.

L. Mount (lately carrying on business under the style of C. J. Mount & Co.), electrical dealers, Brakenhurst, Uxbridge Road, Hayes End, Middlesex.—First meeting October 2nd at 29, Russell Square, W.C. Public examination November 13th at the Court House, Brentford.

W. F. Welford, electrical engineer, Roseberry, Alexandra Road, Shanklin, I. of W.—Last day for receiving proofs for dividend October 9th. Trustee, Mr. A. L. Medcalf, 87, High Street, Portsmouth, Official Receiver.

W. H. Tordoff, electrical engineer, 10, Burnett Avenue, Bradford.—Last day for receiving proofs for dividend October 7th. Trustee, Mr. W. F. Cresswell, 71, Manningham Lane, Bradford, Official Receiver.

M. Franks, electrical and radio engineer, 4, Bayford Road, Littlehampton.—Public examination November 4th at the Court House, Brighton.

W. Collier, electrical contractor, 24, Princess Road, Urmston.—Receiving order made September 22nd on debtor's own petition.

Company Liquidations

Vincents (Radio & Electrical), Ltd.—Winding up voluntarily. Liquidator, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.

Vincents (Radio & Electrical), Ltd., Station Road, Addlestone.—The statutory meeting of creditors herein was held recently at the offices of Messrs. Corfield and Cripwell, Balfour House, Finsbury Pavement, London, E.C.2. The statement of affairs submitted showed liabilities of £419 and net assets of £234, leaving a deficiency so far as the unsecured creditors were concerned of £234. The creditors passed a resolution confirming the voluntary liquidation of the company, with Mr. W. Osborne, of Messrs. Corfield and Cripwell, as liquidator.

T. B. Watson & Son, Ltd.—Winding up voluntarily. Liquidators, Messrs. A. A. B. Walford and W. J. E. Ringquist, Finkle Chambers, Stockton-on-Tees.

Mitchell Electric Co., Ltd.—Winding up voluntarily. Liquidator, Mr. W. Le R. Hand, 12, Cherry Street, Birmingham.

Dissolutions of Partnership

Jones & Jennings, electrical and mechanical engineers and contractors, 4, Great Queen Street, Kingsway, W.C.2.—Mr. R. A. Jones informs us that the partnership existing between him and Mr. W. T. Jennings has been dissolved. Mr. Jones will carry on the business and accept all debts.

The Electrical Power Equipment Co., electrical engineers and contractors, 31, Bromsgrove Street, Birmingham.—Messrs. E. A. Morris and C. Webb have dissolved partnership.

Electricity Supply

Lighting, Domestic, Power

Aberdeen.—Cable Work.—At its recent meeting the Council authorised an extension of the electricity mains from Oldmill to Kingswells, at an estimated cost of £4,715. Cables of greater capacity than at present are to be laid in connection with the supply to the Stoneywood estate, the cost of the work being about £650.

Ayrshire.—Board's Activities.—Electricity is now available in most parts of the county, and the charges are the same thoughout the area, except to a very few consumers, states Mr. W. C. Bexon, engineer and general manager, Ayrshire Electricity Board, in his report for the twelve months ended May 15th last. During the year, 4,803 consumers were connected, this being the highest number recorded in any year, and the total sales rose by 12.65 per cent. to 71,890,798 kWh. The greatest expansion was in heating (27 per cent.). Cookers on hire at May 15th last numbered 1,027, against 840 a year before. Considerable extension of the use of electricity for public lighting is revealed. In the year ended May 15th, 1935, the increase in this field was only 45,635 kWh, whereas during the past year sales for public lighting rose by 470,536 kWh to 1,433,226 kWh. The revenue of the Board advanced by £21,819 to £340,309, and working expenses by £31,053 to £222,126. The net profit on the year's working was £3,856, against £6,235 in the previous year.

Bath.—Choice of Lighting.—Before deciding which type of lamp shall be used for relighting a stretch of the main road, the Surveying Committee is holding a demonstration. The choice will be between 400-W mercury electric-discharge lamps in either round or square lanterns, 150-W sodium electric-discharge lamps, and 1,000-W filament lamps.

Bedford.—Distribution.—Among the more important mains extensions to be carried out by the Electricity Committee are those to the Land Settlement Association's property at Chawston, costing £600, and to the Bromham Mental Hospital (£855). In addition, further radial feeders are to be provided to serve the distribution system, at a cost of £9,260. Sanction has been obtained from the Electricity Commissioners to a loan of £24,400 for extensions.

Birmingham.—Special Tariff for Coronation Illuminations.—It is announced that the Electricity Department will provide supplies for approved special illuminations during the Coronation festivities at 1d. per kWh.

Water Heater Hire Scheme.—A hire scheme for domestic water heating apparatus is being put into operation. The choice is between a circulator fitted into the existing hot-water tank, a 1½-gal. automatic thermal storage water heater, and a dual-purpose wash boiler, the hire charge in each case being 2s. 6d. per quarter, including wiring, fixing, plumbing, and maintenance. The minimum period of hire is a year, and agreements are subject to approval after inspection of premises.

Brighton.—Sub-station.—The Electricity Committee is to provide a sub-station at Withdean Court at a cost of £3,401.

Electricity at Woodingdean.—In response to a request, the Electricity Committee has promised to install electric street lighting on the Downs estate, Woodingdean, when the roads are made up.

Sub-station.—Application is to be made by the Corporation for permission to borrow £2,620 for the erection of a sub-station to supply a new block of flats.

Chester.—Electric Street Lighting.—The Council's agreement with the United Gas Co. for street lighting in the areas added to the city is to be terminated. A scheme for electric lighting has been prepared by the electrical engineer, the estimated cost being £1,251.

Extensions.—Works are to be carried out in the Newton Park district, including the laying of high and low voltage cables and the erection of sub-stations, at a total estimated cost of £2,268. Sanction has been obtained by the Electricity Committee to a loan of £8,500 for new mains and sub-station equipment in connection with the supply of electricity to Reliance Works, Liverpool Road, and for changing over apparatus from d.c. to a.c. A site for a sub-station has also been acquired at Upton, while in connection with the extensions of the electricity supply in the Sandy Lane district a loan of £1,967 has been sanctioned.

Colwyn.—Overhead Lines.—Consent has been given by the Rural District Council to the S.W. & S. Electric Power Co. erecting overhead cables at Llanelwedd, in order to supply electricity to Cefndyris.

Coventry.—New Equipment.—The Electricity Committee is seeking permission to borrow £21,141 for plant and mains extensions.

Croydon.—Supply Extension.—Mains are to be extended at a cost of £530 to the works of Canada Foils (Britain), Ltd., at the Croydon Factory estate; to the new factory of Trojan, Ltd., in Purley Way (£355); and to a new crematorium at Mitcham cemetery (£748).

Electrical Equipment.—Sanction has been obtained by the Electricity Committee to a loan of £4,952 for an ash conveyor, £4,250 for alterations at the generating station and £1,174 for plant.

Dorchester.—Rural Supplies.—The Rural District Council has requested the Weymouth Corporation to expedite the installation of electric lighting and power in those parishes in the rural district in respect of which it has the appropriate powers but where no supply is yet available.

Gellygaer.—Shopping Week Lighting Tariff.—The Urban District Council has decided to supply electricity for window lighting, signs, &c., during the forthcoming shopping week at 1d. per kWh.

Gloucester.—Move to Obtain Cheaper Supplies.—Support has been given by the Rural District Council to a move by the Stroud R.D.C. to obtain cheaper electricity. The latter authority expressed the opinion that the charges of the West Gloucestershire Power Company were excessive, and asked that the Gloucester R.D.C. should co-operate in negotiations to obtain a reduction. When the matter was discussed at Gloucester it was revealed that a letter had also been received from the Sodbury R.D.C. seeking support for a resolution on the same subject.

Grays.—Inquiry.—A Ministry of Transport inquiry was held on September 25th into the application of the County of London Electric Supply Co., Ltd., for permission to erect overhead lines in the area of the Thurrock Urban District Council.

Grimsby.—New Equipment.—The Estates Committee recommends the purchase and installation of certain new electric lighting fittings and the modification of other fittings in the Town Hall, at a cost of £750. It is also proposed to purchase electric clocks and to provide new movements in various other clocks.

Guisborough.—Loans.—The Urban District Council has applied for loans of £1,500 for mains, £1,000 for services, £1,000 for meters and £500 for rental wiring.

Ilford.—Loans Sanctioned.—The Corporation is to borrow £2,670 for mains and sub-station equipment and £20,000 for consumers' electrical apparatus.

Irish Free State.—Compensation Claims Against E.S.B.—Claims amounting to thousands of pounds against the Electricity Supply Board were heard at arbitration proceedings held recently at Limerick by Mr. Geo. Hewson, State Arbitrator. A number of fishery owners claimed compensation for the acquisition of fisheries by the E.S.B. under the Shannon Fishery Act, 1935. The arbitrator made awards ranging from small sums to £4,250, and reserved his decision in several cases, including a claim for £22,633.

India.—Electricity in the Punjab.—According to a recent report of the Punjab Electricity Department excellent progress has been made in the electrical development of the province, and the soundness and reliability of the Uhl River plant have been further proved. The period under review opened with a daily output of 43,000 kWh which, during the year, rose to over 103,000 kWh. The quantity of electricity transmitted through the 132-kV system during the year was 22,727,000 kWh. The Electricity Department now operates nineteen town distribution schemes and has two important bulk consumers, namely, the Amritsar municipality and the North Western Railway. The annual revenue was better than that of the previous year by something like Rs. 4 lakhs. Efforts are being made by the department to assist agriculturists to adopt electric pumping for irrigation. The growth of demand in certain districts has compelled the Government to consider the duplication of the transmission line from Shalimar to Lyallpur and between Ferozepur and Ludhiana, and a preliminary survey has been carried out. A number of electrification schemes were sanctioned by the Government during the year. In addition to these, detailed projects at Lyallpur, Batala, Jullunder and Kangra (rural) were in the course of preparation at the end of the year. The chief difficulty that had to be faced was the remarkable amount of vibration, due to natural causes, to which the trunk and branch transmission lines were subject. After prolonged investigation a cheap and simple anti-vibration device has been discovered, and the work of installation of these fittings throughout the main transmission line has been started. The fittings were designed locally as a result of investigations by the Electricity Department. On branch transmission lines interruptions were commonly due to large birds settling on the insulators. A suitable type of bird guard has now been evolved.

Keighley.—Coronation Celebrations.—Illuminations and floodlighting are to be provided by the Electricity Committee, at a cost not exceeding £1,000, in connection with the Coronation celebrations.

London.—Poplar.—In connection with the Coronation celebrations the Electricity Department has decided that it will connect apparatus for street illuminations at a fee of 6d. per connection, the apparatus to be of a design approved by the department. Electricity will be supplied free of charge from 6 p.m. on May 11th until 6 a.m. on May 13th for registered connections of the foregoing type.

Arrangements have been made with the London County Council regarding the provision of rising mains at new flats to enable electricity to be supplied for all domestic purposes and so that the tenants may take advantage of the Council's hiring schemes for cookers, water heaters, wash boilers, fires, irons, &c. To provide this additional load without increasing the d.c. mains and converting plant at the High Street sub-station it is necessary to build and equip an a.c. sub-station in

the vicinity, and a site in Dolphin Lane has now been obtained.

ST. PANCRAS.—Under the provisions of the London County Council (General Powers) Act, 1933, £13,950 of the £38,678 net surplus on the working of the undertaking during 1935-36, which is equivalent to 1½ per cent. of the outstanding debt of the undertaking (£930,595), may be utilised for the relief of rates. A sum of £7,000 has already been applied in respect of the March-September period, and it is proposed to apply the balance of £6,950 in the ensuing half year. As regards the remaining £24,728, this is to be used to meet expenditure on the following works: Part cost of erection of mains and meter departments, £7,346, and the change-over from d.c. to a.c. in northern and south-eastern areas of the borough, £17,382.

The Borough Council is to extend mains at a cost of £3,532, and lay new mains and provide equipment at Camberley House sub-station at a cost of £4,190.

BATTERSEA.—The Electricity Committee recommends reductions in charges which are estimated to benefit consumers by £16,000 in a year. It is proposed to reduce the lighting flat rate from 3d. to 2¾d. per kWh and the heating and cooking rate from 1d. to 0.95d. per kWh. Under the two-part tariffs the running charge will be reduced from ⅝d. to ½d., while the price for outside shop lighting is to be lowered from 2.15d. to 2d. per kWh.

The Council's buildings are to be electrically floodlighted in connection with the Coronation at a cost of £300.

Lowestoft.—UNDERGROUND INSTEAD OF OVERHEAD.—The Electricity Committee proposes to replace overhead lines at Broad View Road, Oulton Broad, and Chestnut Avenue by underground cables, at an estimated cost of £1,100.

Manchester.—CORONATION FLOODLIGHTING.—Last week the Town Hall Committee discussed supplementary arrangements for the civic celebrations on Coronation Day, and decided that there should be floodlighting of the tower of the Town Hall, the Cathedral, Piccadilly Gardens, the Assize Courts, and the Art Gallery.

Morecambe.—OVERHEAD LINE EXTENSIONS.—The Electricity Committee is to extend the high-voltage overhead lines at Middleton and Overton in order to make a supply of electricity available to houses in Carr Lane, to certain farms in the vicinity, and to Sunderland Point. The cost will be about £1,200.

One of the largest swimming pools in the Midlands—at Knowle, Warwickshire—in the illumination of which "Realux" (Rowlands Electrical Accessories, Ltd.) overhead mounting floodlight fittings are used

Northern Ireland.—BELFAST.—Last week a new 30,000-kW Metropolitan-Vickers turbo-alternator set was officially put into commission at the City Council's Harbour power station.

Norwich.—SUB-STATIONS.—The City Council has applied for a loan of £13,209 to meet expenditure on proposed new sub-stations.

Portsmouth.—RATE RELIEF DECISION RESCINDED.—Last week the City Council, on a notice of motion by Councillor W. J. Lewis, chairman of the Electricity Committee, rescinded the decision made earlier this year to allocate 1½ per cent. of the outstanding capital of the municipal trading undertakings each year to the relief of the rates.

Port Talbot.—INDUSTRIAL DEVELOPMENT SCHEME TO PROCEED.—Last Friday, after hearing the result of a deputation's talk with the Electricity Commissioners, the Town Council decided to sign a tripartite agreement between the Corporation, the Town and Factories Development Co., and the Central Electricity Board. Prior to the signing of the agreement Mr. Tal Mainwaring reported that the Central Electricity Board had been very helpful and had gone out of its way to make a contribution towards the development of Port Talbot in the interests of the unemployed by spending an extra £50,000 to carry its line three miles farther than had been originally intended. Under the terms of the agreement, continued Mr. Mainwaring, Port Talbot would have to take its supply of electricity from the new steam and electricity generating station which the Development Co. would erect at Margam, near Port Talbot. The scheme provided for taking a supply at a point near Briton Ferry, and it was estimated that the cost to the Corporation would be from £7,000 to £8,000. Port Talbot and West Hartlepool, he added, were the only two towns in Britain where the Board was going to allow the erection of stations employing new methods in the supply of electricity. The whole scheme had been thoroughly investigated by the sub-committee appointed for the task and the members were unanimously in agreement.

Sedgefield.—UNDERGROUND CABLES.—As the Rural District Council has objected to the erection of overhead lines, the North-Eastern Electric Supply Co., Ltd., has agreed to use underground cables through the Cow Gap, Sedgefield.

Stanley (Durham).—ELECTRIC-DISCHARGE LIGHTING.—A system of electric-discharge lighting was recently switched on along part of the main road as an extension of the existing lighting.

Stoke-on-Trent.—CONCESSIONS.—The quantity discount now allowed for lighting on the ordinary tariff is being extended to the long-hour lighting tariff as from the end of September. In addition, the minimum guaranteed consumption under the all-in tariff and assisted wiring scheme "C" is being reduced from 30 to 24 kWh per week.

LOANS.—The Electricity Commissioners have sanctioned the following loans: £15,000 for works in connection with the change-over from d.c. to a.c.; £1,200 for mains, etc., for improving the supply to the Newport Lane area and Burslem sewage works; £1,000 for the provision of additional supplies to the Barlaston Old Road and Hem Heath areas; £785 for Drubbery Lane sub-station building; £20,000 for general sub-station extensions; and £950 for plant at the Townsend, Bucknall, sub-station.

MAINS EXTENSIONS.—The City Council has approved mains extensions costing £7,212 as follows: Northern area, £1,470; central area, £1,707; south-eastern area. £2,495; south-western area, £1,125; and Wolstanton area, £415.

FEEDER EXTENSION.—As the engineer has reported that extensions are necessary owing to the increased loads on the high-voltage system in the southern portions of the city, the Electricity Committee is to make application for sanction to borrow £6,250.

CHANGE-OVER.—It has been decided to proceed with the change-over of the supply in the Stafford Street and Commerce Street area of Longton, at a cost of £4,500, and the Trentham Road and Normacot Road area of Longton, at a cost of £3,000.

SUB-STATION DEVELOPMENTS.—Application is to be made for sanction to borrow £2,200 for the erection and equipment of a sub-station at Anchor Road, Longton. In addition, instructions have been given to the electrical engineer to purchase sites for new sub-stations at Trentham Road, Blurton; Bellerton Lane, Milton; and Gate Street, Longton. Additional transformers and switchgear to cope with increasing loads are to be provided at the Newcastle Street, Burslem, sub-station and the Hanley sub-station, while additional low-voltage switchgear is to be provided at the Kingsway, Stoke, sub-station. Architect's designs for new sub-stations at James Street, Stoke-upon-Trent; Bankhouse Road, Hanford; and Townsend, Bucknall, have been approved by the Electricity Committee. A sum of £3,000 has been set aside for replacement of early-type current transformers in various sub-stations during the next two years.

Sunderland.—SUCCESS OF ILLUMINATIONS.—In view of the popularity of the illuminations, they have been extended for a week (until Sunday). In eleven days more than 200,000 people visited Roker Park to see them, and £4,600 was received in entrance money, apart from a sum of nearly £450 taken at dance band concerts in the park.

CORONATION PLANS.—The Town Council proposes to floodlight the Town Hall, Bishopwearmouth Church, certain streets, &c., on May 12th next year in connection with the Coronation celebrations.

Sutton Coldfield.—LIGHTING.—The Town Council is to provide improved lighting in Jockey Road and Boldmere Road at an estimated cost of £894.

MAINS.—To supply two new roads between Maney Hill Road and Coles Lane, where 156 houses are to be built, the Council is to extend its mains at a cost of £854.

Trimdon (Co. Durham).—ELECTRIC LIGHTING.—The Parish Council is to enter into an agreement with the North-Eastern Electric Supply Co., Ltd., for the future lighting of Trimdon Village, Trimdon Grange, and Trimdon Colliery.

Wallasey.—LOWER CHARGES.—A recommendation has been passed by the Electricity Committee for reductions in the electricity charges, namely, a lower fixed rate under the two-part tariff and ¼d. per kWh off the lighting rate.

Traction

Argentina.—TWENTY YEARS OF ELECTRIC TRACTION.—August 24th was the twentieth anniversary of the opening of the electrified section of the Central Argentine Railway between Retiro and Tigre "C," the first railway electrification in South America. In an article on the subject the *Review of the River Plate* recalls that, initially, a power station with 12,000-kW of generating plant was built at Canal San Fernando, and 117 electric coaches were used in the operation of the new service. However, the increase in traffic was such that in 1927 it was necessary to augment the plant at the power station by a 6,000-kW set and to construct two new sub-stations of the automatic type, additional coaches being put into service. In 1931 the company completed the electrification of the Retiro to Tigre "R" and Villa Ballester lines, bringing the total length of electric track to 180 kilometres, and making the Central Argentine electrified system the largest broad gauge electrification in the world. The extension necessitated a further increase in generating plant and the capacity of the power station was raised to 30,000-kW. Three new remotely controlled automatic sub-stations—the first of their kind in Argentina—were erected, and new electric coaches of the latest type of semi-steel construction were acquired, making the total electric rolling stock 370 coaches. By electrification the schedule speed of the trains was raised from 30.7 to 44.4 km. per hr., and the number of trains per day was considerably increased. During the past six years rapid progress has been made with the installation of a system of automatic signalling.

Burma.—TROLLEY-BUSES IN RANGOON.—About twelve months ago the Rangoon Electric Tramway & Supply Co., Ltd., placed an order for fifteen trolley-bus chassis of a special type designed by Sunbeam Commercial Vehicles, Ltd., for use with lightweight single-deck bodies. The electrical traction equipment supplied by the B.T.H. Co. has been designed and manufactured especially for this type of chassis, the 31-seater bodies being built in the Rangoon Company's workshops. The first route for public service was officially opened on August 17th by the Mayor of Rangoon. During the proceedings it was stated that this was the first trolley-bus service of considerable size to be introduced in India or Burma, and if it were well supported by the public the company proposed, with the concurrence of the authorities concerned, gradually to replace the tramways by a system of trolley-buses.

Czechoslovakia.—TROLLEY-BUSES.—A trolley-bus service has been instituted betwen Prague and the suburbs of Stresovice and Svaty Matej. This is stated to be the first of its kind in the country.

Italy.—ELECTRIFICATION WORK.—According to *The Times*, a Royal Decree has been issued authorising an expenditure of 1,200,000,000 lire (nearly £20,000,000 at current rates) in connection with railway electrification. This work, it is emphasised in the Italian Press, will eventually lead to a reduction in the purchases of foreign coal and will mark a further stage on the road towards Italian self-sufficiency. The programme of railway electrification announced in 1933 included the conversion of 4,365 kilometres (2,728 miles) of line to electric operation, and with its completion 41 per cent. of the railway network of the country, carrying 60 per cent. of the total traffic, will be using electricity derived chiefly from water power.

London.—METROPOLITAN LINE ELECTRIFICATION.—The London Passenger Transport Board has decided to electrify the Metropolitan Railway branch line between Chalfont and Chesham. The original intention was to use Diesel railcars on this branch line.

New Zealand.—WELLINGTON.—Mr. M. Cable, the general manager of the Transport Department, reports that during 1935 the debit balance of £346 incurred during 1934 was turned into a surplus of £793. The number of passengers carried increased by 2,669,953 to 41,874,801, and the car miles run amounted to 4,138,389, the average receipts per tram mile being 20.3d. and the working expenses 15.24d. The number of trams owned by the department at the end of March last was 196, and it operated 17¼ miles of double and 14 miles of single track.

South Africa.—JOHANNESBURG.—On September 4th a representative gathering of Johannesburg city councillors and officials travelled over the new trolley-bus route in one of the Sunbeam-B.T.H. four-wheel double-deck vehicles which were recently supplied to the Corporation Transport Department. These vehicles were described in the ELECTRICAL REVIEW of February 7th, 1936. The full public service over the new route commenced on September 7th.

South Shields.—TROLLEY-BUSES.—October 8th is the date provisionally fixed by the Town Council for the introduction of its first trolley-bus service between the Market Place and Cleadon, *via* Prince Edward Road. Four buses will be used on this route.

Straits Settlements.—GEORGE TOWN.—The Tramways Department (manager, Mr. T. Rogers) completed its thirtieth year of working during 1935. Trolley-buses were introduced by the department as long ago as 1924-25; in the first instance they superseded petrol buses, and proved very comfortable and more economical than the petrol type. In 1929 the Jelutong tram route was converted to trolley-bus operation, with the result that many more passengers have since been carried. The only part now left of the old tramway system is the Ayer Itam section, and this is to be changed over to trolley-bus working by the end of the present year. There has been a further increase in passengers carried, from 8,789,162 in 1934 to 9,609,094 in 1935. The total revenue was $253,908, an increase of $17,903, and the expenditure $234,436, which was $6,407 more than in 1934.

Wimbledon.—TRAMS UNPOPULAR.—The Town Council has decided to press for the abolition of the tramways in the borough.

Communications

Belgium.—TELEPHONE PROGRESS.—In the report of the Belgian Telephone and Telegraph Department for 1935 it is mentioned that about 11,000 new subscribers and 16,000 instruments were connected to telephone exchanges in Belgium during the past twelve months, bringing the totals to about 250,000 and 335,000, respectively. Arrangements are in progress whereby subscribers served by automatic exchanges will shortly be able to secure direct communication between such large centres as Brussels-Mons, Brussels-Louvain, Brussels-Malines, Antwerp-Liége, Antwerp-Malines and Antwerp-Ghent.

Denmark.—NEW TELEPHONE CABLE.—It is expected that an estimate of kr. 1.5 million will be included in the next Danish budget for a telephone cable between Aalborg and Hjorring. This scheme prepares the way for future cables *via* Frederikshavn to Gothenborg, Sweden, and *via* Hirtshals to Norway.

Great Britain.—TELEVISION.—Following the experimental demonstrations of television at Radiolympia a period of trial transmissions began yesterday (Thursday), the transmission times being from 11 a.m. to 12 noon and 3 p.m. to 4 p.m. Details of the transmissions will not be regularly announced, but the public will be kept informed of the system to be used and of any change in the hours. This week the Baird system is being employed, and during next week the Marconi-E.M.I. system will be used. Subsequently, each system will be used during alternate weeks. There will be no transmission on Sundays.

A SCOTTISH TRANSMITTER.—The B.B.C. announces that the Burghead transmitting station will be brought into service on October 12th, using the same wavelength as that allotted to the Scottish Regional transmitter, namely, 391.1 metres (797 kc/s).

PORTO RICO TELEPHONE SERVICE.—Last week the Postmaster-General announced that, as from yesterday (Thursday), a telephone service would be available to all parts of the island of Porto Rico. The charge for calls from Great Britain and Northern Ireland is £4 16s. for the first three minutes, and £1 12s. per minute thereafter.

CHEAPER LONG-DISTANCE TELEPHONE CALLS.—Yesterday (Thursday) reduced charges, varying between £4 16s. and £7 4s. for three minutes, came into operation for telephone calls to the Bahamas, Colombia, Costa Rica, the Dominican Republic, Guatemala, Hawaiian Islands, Honduras Republic, Nicaragua, and Panama.

India.—BROADCASTING PLANS.—The Standing Finance Committee of the Indian Legislative Assembly has now approved plans submitted to it after the Government had considered the recommendations of Mr. H. L. Kirke in regard to radio services in India. The principal proposals are for the erection of eight new broadcasting stations and the taking over of the station hitherto maintained by the Frontier Province Government at Peshawar. The total expenditure on the new stations, on the remodelling of the transmitters at Bombay and Calcutta, and on research and other necessary developments will amount to Rs.33 lakhs. There is also a provision in the programme for a short-wave relaying receiver at Delhi, and for the erection of a suitable building at New Delhi for the studio and office of the local broadcasting station and to accommodate the research department and the office of the Controller of Broadcasting. After these stations are constructed and the wavelengths tested, the question of evolving a cheap set for India to meet mass needs will be considered. One of the difficulties of radio services in villages is that the community set is expensive, and the cost of the battery makes it difficult for provincial governments to launch a scheme of expansion on any large scale. Research is now in hand in this direction. Two alternatives are under consideration. One is to take advantage of the electricity used for tube wells, and the other is to evolve a wheel which, when worked by hand by the villagers, will generate enough electricity to run the radio set. Mr. Goyder, chief engineer, All-India Radio, is visiting Java to secure information regarding the broadcasting services there, as conditions in India are more comparable with those in Java than elsewhere. The visit may assist him in his researches regarding wavelengths and receiving sets.

TRUNK TELEPHONE DEVELOPMENT.—The Standing Finance Committee has sanctioned an expenditure of Rs.13 lakhs on telephone development. The most interesting item in the programme is the installation of a new automatic exchange in New Delhi, with an ultimate capacity of 3,000 lines and costing over Rs.5 lakhs. This exchange should be ready by October, 1937. Other telephone schemes approved of are those which either provide for a new exchange or the improvement of existing facilities.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Acton.—October 7th. Town Council. Vehicle-actuated traffic signals at the junction of Acton Lane, Winchester Street and Avenue Road. Borough engineer, Municipal Offices, W.3.

Argentina.—BUENOS AIRES.—October 9th. State Oilfields Directorate. Four electric motors and accessories. (T.Y. 30765.)*

Australia.—MELBOURNE.—December 1st. State Electricity Commission of Victoria. Two transformer circuit-breakers, one bus tie circuit-breaker unit, one station transformer circuit-breaker unit, eight feeder circuit-breaker units, two current transformers and transfer trucks. (T. 30804.)*

Birmingham.—October 5th. Electric Supply Department. Up to 1,000 two-part tariff prepayment meters. (September 25th.)

Bridlington.—October 15th. Town Council. New posts and fittings for the conversion of the main street lighting to electric-discharge illumination, together with minor improvements. (See this issue.)

Cardiff.—October 16th. Electricity Department. Six 500-kVA, 3-phase transformers. (See this issue.)

Dumfries.—October 5th. Town Council. Electrical work in thirty-four houses at Nithside. Burgh surveyor.

Egypt.—CAIRO.—November 2nd. Ministry of Public Works, Mechanical and Electrical Department. Electrical fittings for one year, including lamps, wires, tubes, cables, switches, &c., for pumping and power stations. Inspecting engineer, Egyptian Government, 41, Tothill Street, London, S.W.1.

Erith.—October 19th. U.D.C. Electricity Department. Electric lighting and heating installation at the bulk supply station, Walnut Tree Road. (See this issue.)

Fife.—October 5th. County Council. Electric lighting at sixty-eight houses at Lochore and eighty-four at Rosewell, Lochore (separate schemes). C. R. Douglas & Son, surveyor, 15, East Port, Dunfermline (deposit £1 1s. each).

October 13th. Electrical work at new clinic, Buckhaven. G. Sandilands, County master of works, Property and Works Department, County Offices, Kirkcaldy (deposit £1 1s.).

Goole.—October 6th. Borough Council. Electrical work in fifty houses. J. H. Castle, borough engineer, Municipal Offices (deposit £3 3s.).

Grangemouth.—October 27th. Town Council. Works in connection with the construction of an electrically operated steel swing bridge at Junction Dock, and an electrically operated steel bascule bridge at Lock No. 2. Crouch & Hogg, civil engineers, 17, Lynedoch Street, Glasgow, C.3 (deposit £5 5s.).

Harrogate.—Electricity Department. Cables for one year. (September 25th.)

Horwich.—October 12th. U.D.C. Installation of electricity, including fittings, at the Maternity and Child Welfare Centre, Jones Street. T. Green, electrical superintendent, Public Hall.

India.—NEW DELHI.—October 27th. Stores Department. 4,500-kW, 6,600-V turbo-alternator set, condensing plant and auxiliaries. (T. 30779.)*

November 3rd. Silk and cotton covered copper wire for winding purposes, during the year from March 1st, 1937. (T. 30822.)*

Manchester.—October 29th. Electricity Department. 33-kV and 6.6-kV, 3-phase, a.c. switchgear at Dickinson Street sub-station; four 660-V, d.c. switchboards at various sub-stations; and 420-V, 3-phase, a.c. switchgear at the Barton-upon-Irwell power station. (See this issue.)

Middlesex.—October 22nd. County Council. Eleven electrical service lifts at the Shenley Mental Hospital. (September 25th.)

October 28th. Electrical installations at the new Grammar School, White Hart Lane, Tottenham. (See this issue.)

Newcastle-upon-Tyne.—October 10th. Transport and Electricity Committee. Twenty-five double-deck trolley-buses with chassis and electrical equipment. T. P. Easton, general manager, transport and electricity undertaking, Manors (deposit £2 2s.).

New Zealand.—WELLINGTON.—November 10th. Public Works Department. Nine switch-fuse limiting resistance combinations and five sets of galvanised steel structures, each set to carry one 100-kV, 3-phase switch-fuse limiting resistance combination, with climbing steps and brackets for switch operating mechanism. (T. 30798.)*

November 24th. Seven 1,000-kVA, 50-kV/11-kV, oil-immersed, single-phase transformers and spares for the Arapuni power scheme, section 527. (T. 30803.)*

Plymouth.—October 3rd. Electricity Department. L.v., underground network disconnecting boxes. (September 18th.)

Prestatyn.—October 9th. Electricity Department. Four static balancers. (See this issue.)

Preston.—October 12th. Corporation. Wiring for electric lighting at the Institution, Fulwood. (September 25th.)

Shoreham-by-Sea.—October 19th. U.D.C. Alternative tenders for lighting Parkside Street, Kingston-by-Sea, by electricity or gas. J. Dunn, surveyor, Town Hall.

Sleaford.—October 19th. U.D.C. Electricity Department. One steel kiosk; e.h.v. and l.v. switchgear. (See this issue.)

South Africa.—CAPE TOWN.—October 16th. Public Works Department. Electric cooking apparatus, refrigerators and food preparation machines for the Hospital, Groote Schuur. (T. 2008.)*

October 21st. Electricity Department. 230-V electric lamps of various wattages. (T. 30792.)* Single- and double-pole iron-clad service cut-outs. (T. 30795.)* Overhead line material. (T. 30796.)*

October 28th. Two 3,000-kVA transformers. (T.Y. 30797.)*

JOHANNESBURG.—October 26th. Railways and Harbours Administration. Telegraph material. (T.Y. 30826.)*

PRETORIA.—October 23rd. Union Tender and Supplies Board. Twenty lamp signalling, multiple type, private branch switchboards. (T. 30774.)*

RUSTENBURG.—October 30th. Municipality. Three 250-kW generators, engine room crane, condensing plant, circulating water plant, switchgear, transformers, erection gear, transfer of existing engines and electric master clock. (T. 30790.)*

Southend.—November 19th. Electricity Department. One 750-kW alternator. (September 25th.)

Swansea.—October 5th. Electricity Department. 33,000-V outdoor sub-station. (September 18th.)

Tadcaster.—October 6th. R.D.C. Automatic, electrically controlled pumping plant and appurtenant works for the Sherburn-in-Elmet sewage scheme. J. Worthington, engineer and surveyor (deposit £2 2s.).

Tiverton.—October 5th. Town Council. Vehicle-actuated traffic signals. W. H. Duncan Arthur, borough surveyor, Town Hall.

Uruguay.—MONTEVIDEO.—November 13th. State Electricity Supply and Telephones Administration. Electric metering apparatus, consisting of voltmeters and ammeters, &c. (T.Y. 30788.)*

November 17th. Insulating tape. (T.Y. 30808.)*

November 20th. 3,000 porcelain insulators for overhead power transmission lines. (T.Y. 30809.)*

West Ham.—October 15th. Education Committee. Electric lighting at the extension of Fyfield residential open air school. (See this issue.)

West Sussex.—October 3rd. County Council. Provision and wiring of electrical plant and buildings at Drayton Depôt, near Chichester. (September 25th.)

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* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Aberdeen.—Housing Committee. Accepted. Electric lighting work at thirty houses on the Hayton Road estate and 100 houses on the Woodside estate.—R. A. Mair. Electric lighting work at 126 houses on the Hayton Road estate.—J. B. Reid.

Australia.—CAMPBELLTOWN (N.S.W.). — Municipal Council. Accepted. Cable.—B. I. Cables, Ltd.

MELBOURNE (VICTORIA).—City Council. Accepted. Insulating tape.—British General Electric Co.

BRISBANE (QUEENSLAND).—City Council. Accepted. 2,000-A, continuous rated rectifier unit, control gear and accessories (£4,904).—British General Electric Co. Oil circuit-breaker.—A. Reyrolle & Co.—*Tenders.*

Birmingham.—Accepted. Electrical switchgear at Bordesley Green junior technical school.—G.E.C. Electric lighting installation at Kingsland Road infants' school.—E. Cooper (Electricians), Ltd.

Brierley Hill.—Accepted. Electric lighting in houses and bungalows.—Midland Electric Corporation for Power Distribution, Ltd.

Croydon.—Electricity Committee. Recommended. Filtering equipment (£311).—Stream Line Filters, Ltd. Valves (£185).—Hopkinsons, Ltd.

Durham.—County Education Committee. Accepted. Electrical work at Auckland Park school (£110), Howden-le-Wear school (£72), and Durham Girls' County school (£559).—R. Robson.

Essex.—Public Assistance Committee. Accepted. Electrical installation at new buildings at Sutton's Institution (£4,563).—E. Beckwith & Co.

Falkirk.—Corporation. Accepted. Electric lighting work at housing estates at Bainsford and Camelon.—T. J. Irvine.

Irish Free State.—CORK.—City Vocational Committee. Electric lighting and power installations in the new School of Commerce:—

	£		£
J. D. Carr & Co. Accepted ...	2,274	Porte & Co.	3,096
Nolan Bros.	2,430	Electricity Supply Board ...	3,200
O'Shea's, Ltd.	2,933	Electrification Co.	3,290
Fitzgerald & Co.	3,090		

Kettering.—Electricity Committee. Recommended. Oil filter (£165).—Metafiltration Co.

Lanarkshire.—County Council. Accepted. Electric lighting in 332 houses at Spring Wells, Blantyre (£1,825).—D. Henderson.

Lanchester (Co. DURHAM).—R.D.C. Accepted. Electrical installations comprising the erection of l.v. overhead equipment for the villages of East Hedleyhope, Rowley and Ebchester.—F. Reid, Ferens & Co.

London.—FULHAM.—Electricity and Lighting Committee. Substation equipment and inter-connecting cables at the Earl's Court Exhibition:—

	£		£
Crompton Parkinson. Accepted	42,146	A. Reyrolle & Co.	50,741
British Thomson-Houston Co....	46,088	English Electric Co.	51,686
General Electric Co.	46,993	Ferguson Pailin	55,275
Met.-Vickers Electrical Co. ...	47,005		

Accepted. Two 10,000-kVA transformers for the Earl's Court Exhibition (£6,971).—Ferranti, Ltd.

Modification of the switchgear at the Hurlingham and May Street sub-stations (£1,596).—Met.-Vick. Electrical Co. Two temporary mixing tanks in connection with the sulphur extraction plant at the generating station extensions (£745) and spare parts for the re-circulating pumps of the sulphur extraction plant (£153).—J. Howden & Co. Temporary reactors for the existing generating station:—

	£		£
General Electric Co.	518	English Electric Co.	610
British Thomson-Houston Co. ...	546	Metropolitan-Vickers Electrical Co.	648
Hackbridge Electric Construction Co. Accepted	**550**	British Electric Transformer Co....	704

Thermal storage plant for the Earl's Court Exhibition (£20,637).—Bastian & Allen, Ltd.

Stirlingshire.—County Council. Accepted. Electrical work in fifty houses at Haggs.—A. H. Muir.

Stoke-on-Trent.—City Council. Accepted. Domestic electric cookers.—G.E.C.; Jackson Electric Stove Co.; Revo Electric Co. Electric wash boilers.—Hogan & Wardrop; Revo Electric Co.; Universal Boilers & Engineering Co.; Elexcel; Burnley Components, Ltd. Electric kettles.—Bulpitt & Sons. Electrical work at Longton Library (£172).—Hawley, Ingram & Co. Public Assistance Committee. Accepted. Cables at Turnhurst Road Institution (£123).—Barnett & Soans.

A view of Purley Way, Croydon, showing the effective and even illumination

Sutton Coldfield.—Town Council. Accepted. Meter testing equipment (£241).—Ferranti, Ltd. Vehicle actuated traffic signals at the junction of Chester Road and College Road, New Oscott (£443).—Siemens & General Electric Railway Signal Co.

Wallasey.—Electricity Committee. Recommended. Turbine repairs (£441) and switchgear (£239).—English Electric Co.

Forthcoming Events

Inventions Exhibition.—Wednesday, September 30th, to Saturday, October 10th. Central Hall, London, S.W.1.

National Smoke Abatement Exhibition.—Thursday, October 1st, to Saturday, October 31st. South Kensington, London, S.W.

Junior Institution of Engineers.—Friday, October 2nd. Institution, London, S.W.1. 7.30 p.m. Informal discussion on three topics, including "Will Electric Power Supplant Hydraulic Power on Lifts and Cranes?"

Electrical Power Engineers' Association (*Southern Division*).—Saturday, October 3rd. Holborn Restaurant, London, W.C.1. Annual dinner to the members of the National Executive Council.

Institution of Electrical Engineers (*North Midland Students' Section*).—Saturday, October 3rd. 3 p.m. Visit to the works of Messrs. Hailwood & Ackroyd, Ltd., Morley.

Institute of Marine Engineers.—Tuesday, October 6th. The Minories, London. E.C.3. 6 p.m. Presidential address by the Hon. Alexander Shaw.

Institution of Engineers & Shipbuilders in Scotland.—Tuesday, October 6th. Presidential address by Prof. P. A. Hillhouse. "Accurate Measurement in the Workshop." Mr. J. E. Sears.

Physical Society.—Friday, October 9th. Imperial College of Science and Technology, London, S.W.7. 5 p.m. Short papers.

Notes

I.E.E. Transmission Section

The annual conversazione and supper dance of the Transmission Section of the Institution of Electrical Engineers will take place on November 4th. The venue has this year been changed to the Criterion Restaurant, Piccadilly, and the charge per person has been reduced to 10s. 6d. There will not be an exhibition of apparatus on this occasion.

The section has issued a book of rules and list of members (totalling 1,653, of whom 274 are full and 806 associate members) together with a chart indicating the subjects on which papers are invited. At the opening meeting on November 11th Dr. P. Dunsheath, the chairman, is to deliver his inaugural address, after which there is to be a display of cinematograph films and photographs taken by members during the summer visits to Mid-Cheshire and France. Members who are prepared to lend films and photographs for this purpose should communicate with the secretary as soon as possible.

Small Undertakings to Confer

At the adjourned conference of representatives of the smaller electricity undertakings in Staffordshire and the adjoining counties held at Newcastle-under-Lyme last week it was decided to call a national conference of all authorities, both municipal and company, representing undertakings with outputs between one million and ten million kWh per annum. It is proposed to hold the conference at the I.E.E. building on October 23rd. The object is to gain support in opposing the recommendation of the McGowan Committee that electricity undertakings with outputs of less than ten million kWh per annum shall be amalgamated with larger undertakings. The initiative in the matter was taken by Mr. A. J. C. De Renzi, borough electrical engineer of Newcastle-under-Lyme.

Sodium Lighting at Croydon

A new public lighting installation at Croydon was started up on Tuesday evening. Approximately four miles of Purley Way is lighted by 235 "Philora" sodium 150-W lamps, spaced 90 ft. apart and mounted at 26 ft. above the centre of the road, only half the normal number of posts being required with this method of suspension. The total width of the road is 60 ft., of which 38 ft. is carriageway. An illumination of 1.0 ft.-candle is obtained under the lamp and 0.7 ft.-candle in mid span.

The sodium lamps are housed in horizontal "Wardle Liverpool" reflectors, designed by Mr. P. J. Robinson, city electrical engineer and lighting engineer of Liverpool, and supplied by the Wardle Engineering Co., Ltd. The installation was planned by Mr. F. N. Rendell Baker. borough electrical engineer of Croydon, and was carried out by Messrs. Philips Lamps, Ltd. Technical particulars of these lamps were published in the ELECTRICAL REVIEW of August 21st.

Activity at Clitheroe

In expressing his appreciation of our leaderette "Growing Up" in last week's issue, Mr. A. H. Todd, the engineer and manager of the Clitheroe Corporation Electricity Department, says that the new cement works in his area is likely to be started up during next month and trial runs of individual plant are now taking place. During the last four days the Department has been officially informed that Ribblesdale Cement, Ltd., Clitheroe, has already placed orders for the machinery required to double the proposed output of cement, and it is expected that the consumption at these works will reach 17½ million kWh per annum. The firm of Messrs. Rd. Briggs & Sons, Bankfield Lime Works, has recently come under new ownership. A new stone-crushing machine and tarmac plant have been installed which are entirely electrically driven, and production was commenced on Monday last week. Tar-heating boilers with an aggregate capacity of 15,000 gallons are installed, and these are already much appreciated, due to the very great saving of time effected. The output of the undertaking will be at the rate of 22½ million kWh per annum by December, 1937, which is seven times its present output.

Appointments Vacant

Sales and installations engineer for the Newport (Mon) Electricity Department.

Meter mechanician for Rawtenstall Electricity Department.

City electrical engineer for Aberdeen (salary £900, rising to £1,050 per annum).

Technical officer at the Royal Aircraft Establishment, South Farnborough.

Assistant sub-station attendant for Hove Electricity Department.

Outdoor collector and meter reader for Brentford Electricity Department.

(See our classified advertisements.)

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

FIXALITE strip lighting holders.

BANKSWAY lighting fittings.

Readers should enclose stamped addressed envelopes when making their enquiries.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. G. Hedley Davis, sales and installations engineer to the Newport (Mon) Corporation Electricity and Tramways Department, has been appointed commercial manager of the Islington Borough Council Electricity Department. Since 1933 Mr. Hedley Davis has been responsible to the borough electrical engineer, Mr. A. Nichols Moore, for the commercial development of the undertaking, during which period two new showrooms have been opened and an already progressive policy in service to consumers further extended. Previous to going to Newport he was assistant sales engineer in the Sheffield Corporation Electric Supply Department, to which position he was appointed in 1928 after some years with the Birmingham Electric Supply Department, where he held an appointment as assistant to the commercial engineer.

Mr. Frank Forrest.—By a slip of the pen on page 396 of our last issue ("The Next Convention") we used the wrong initials when referring to Mr. Forrest, of Birmingham, who is to be president of the I.M.E.A. Convention at Brighton next year. We should, of course, have written Mr. *Frank* Forrest (not Mr. J. S.). Mr. Forrest's official description is "Chief Engineer and Manager of the City of Birmingham Electric Supply Undertaking," not "City Electrical Engineer of Birmingham," as rendered by us.

Mr. J. Greig

Mr. J. Greig, M.Sc., A.M.I.E.E., has resigned his position at University College, London, to take up a lectureship in the Department of Electrical Engineering at the University of Birmingham. Mr. Greig received his technical education at the Heriot-Watt College, Edinburgh, and University College, London. Afterwards he gained much practical experience with the Bell Telephone Co., of Canada, and with the General Electric Co., Ltd., in its Research Laboratory at Wembley. He is the author of a number of papers on the stabilising of high-frequency amplifiers and on the high-frequency induction furnace.

Mr. W. F. Durand, chairman of the Third World Power Conference, has assumed the office of president. **Sir Harold Hartley,** C.B.E., F.R.S., has been re-elected chairman of the International Executive Council to hold office until the next Plenary Meeting, and the following have been elected vice-chairmen, to hold office for three years: First vice-chairman: Mr. O. C. Merrill (U.S.A.), director of the Third World Power Conference; second vice-chairman: Mr. G. J. T. Bakker (Netherlands), president of the Royal Netherlands Institute of Engineers, chairman of the Netherlands National Committee of the World Power Conference; third vice-chairman: Dr. M. Kamo (Japan), Professor, Faculty of Engineering, Tokyo Imperial University, chairman, Japanese National Committee of the World Power Conference.

Mr. L. E. F. Fosbrooke, of the Woolwich Borough Council Electricity Supply Department, has been appointed consumers' engineer to the States of Guernsey Electricity Department. There were 249 applicants for the position.

Mr. W. J. Forster, electricity mains superintendent at Rawtenstall for five years, has been presented with an electric standard lamp and a silver cigarette case by the staff of the Corporation Electricity Department on leaving to take up the position of deputy borough electrical engineer and manager at Heston and Isleworth.

Mr. L. W. Wild, M.I.E.E., of Messrs. Wild-Barfield Electric Furnaces, Ltd., retired on September 6th. He had been associated with the company since its formation in 1917.

Councillor H. Coates, who has accepted the mayoralty of Watford for the Coronation year, is a director of the Watford Electric & Manufacturing Co., Ltd., which he joined in 1914. He served his apprenticeship with Messrs. Mather & Platt, Ltd., and was afterwards with Messrs. Ferranti, Ltd. He has been a member of the Corporation since 1922, and has been chairman of the Electricity Committee since 1925.

Mr. S. L. Filer, assistant electrical engineer to the Tredegar Urban District Council, was married recently at Swansea to Miss V. M. Blackmore.

Mr. W. E. W. Beerling, who has been sales manager to British National Electrics, Ltd., for the last five years, has left the company in order to take up other work. His address is "Goldielea," Uddingston, Lanarkshire.

Mr. W. E. Bush, who some years ago was very actively and prominently engaged upon electrical illumination matters in London and the country generally, is once again devoting part of his energies to such activities in London. His early connection with the British Thomson-Houston Co., Ltd., his work in establishing the Lighting Service Bureau and the running of the E.L.M.A. illumination design courses will be remembered by many of our readers. When he resigned the directorship of the Lighting Service Bureau in 1928 Mr. Bush organised the European business of the Curtis Lighting Companies and became managing director of the companies which he established in France and Belgium, with factories in Paris and Antwerp. While still retaining his direction of these companies, he is devoting the greater part of his time to the Curtis Lighting Co. of Great Britain, Ltd., of Aldwych House, W.C., as managing director. We understand that it is the purpose of Mr. Bush to establish a British industry in silvered glass reflectors through his new company, with works in London.

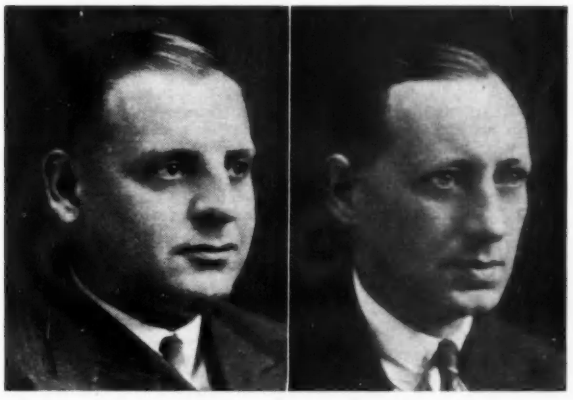
[*Howard Coster*

Mr. W. E. Bush

Mr. T. P. Sykes, manager of the Transport Department of Rotherham Corporation, was married on September 25th to Mrs. Amy Twigg.

Mr. F. G. Nesbitt, manager for cooking and domestic appliances of the Simplex Electric Co., Ltd., and Mr. F. G. Arnott, sales manager, installation supplies, have been transferred to the company's London office, Creda House, 219, Tottenham Court Road, W.1.

A *Reuter* message from Ottawa states that the board of governors of the Canadian Broadcasting Corporation has recommended that the Government shall appoint **Major W. E. Gladstone Murray,** the assistant controller of the B.B.C. since 1935, as general manager of the Corporation. It has also recommended that **Mr. Augustin Frigon,** at present chairman of the Quebec Electricity Commission, shall be appointed assistant general manager. It was stated that both were willing to accept appointment. Major Gladstone Murray was B.B.C. director of public relations, information and publications from 1924 till last year. In 1933 he took part in a special mission to advise the Canadian Government on the development of broadcasting.



Messrs. W. C. Parker, borough electrical engineer, and Mr. H. Clarke, chief generation engineer, who have been largely responsible for the carrying out of the work at the new Fulham power station described in this issue

Obituary

Mr. G. Lauchlan.—The death is reported of Mr. George Lauchlan, a pioneer of the electrical industry in New Zealand. He had been associated with electricity supply affairs in the Dominion for nearly half a century, and was a past president of the Electric Supply Authority Engineers' Association. In 1915 he became assistant manager of the Wellington Electric Light-

ing Department, and in 1926 he was appointed assistant general manager of the undertaking, under Mr. M. Cable.

Dr. D. Schindler-Huber.—The death is announced of Dr. Dietrich Schindler-Huber, chairman of Messrs. Oerlikon, Ltd., and delegate of the board of administration of the Ateliers de Construction Oerlikon. It occurred on September 22nd in his eighty-first year, after a short illness, at his residence in Zurich.

Dr. William Low, D.L., O.B.E., who died on September 22nd in his seventy-ninth year, was the first chairman of the Fife Tramway, Light & Power Co., Ltd.

Will.—Lord Wargrave, chairman of the Westminster Electric Supply Corporation, Ltd., left £253,407, with net personalty of £237,006.

Carbonising Coal Electrically

A NEW process for the carbonisation of coal which promises to be of importance to the electrical industry has been developed in the United States by the Detroit Edison Company at its Delray works.

The process, as at present developed, is an intermittent one, but could be made continuous. The cylindrical retorts are of the vertical type, and a 30-ton retort has been successfully developed and operated. Electrical energy is passed through a "starting fuse" (a column of coke breeze in a suitable container) in the mass of coal. The passage of electricity through this fuse heats it, and the heat is conducted to the adjacent coal, which it carbonises.

When the adjacent coal has been carbonised it becomes a relatively good conductor of electricity, as compared with the starting fuse, and in contrast with the uncarbonised coal. Electricity then flows not only through the fuse but through the carbonised coal or coke also. Thus the coal adjacent to that originally carbonised is heated, carbonised and then, in turn, becomes an electrical conductor, so that a constantly increasing coke core is formed which provides a larger and larger path for electrical flow. As the carbonising continues the coke core is increased until the complete mass is carbonised.

It will be appreciated that the heat for carbonising is applied initially at the surface of the coal and later generated within the coal. It does not have to pass through a containing wall and then through an increasing thickness of carbonised coal, as in the usual processes. This efficient application of heat results in a very fast rate of coking. The gases, both permanent and heated condensate, pass out through the mass of uncarbonised coal, and in doing so give up to this coal a considerable part of their sensible heat.

Single-phase a.c. is used, although in a battery of three or more retorts multiple-phase energy might well be utilised. Quality and yield of gas and coke closely approximate to those of high-temperature carbonisation processes. The coke produced can readily be sold on the open market and is particularly easily ignited.

Flexibility of control is an important feature of the process. Gas can be produced within fifteen minutes from starting and, conversely, the process can readily be stopped.

In the 30-ton retort an average consumption of 350 kWh is required to carbonise a ton of coal, producing 10,000 cu. ft. of gas.

The electrical industry may yet find in its rival a valuable customer for its off-peak surplus power.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Wakefield Electrical Engineering Co., Ltd.—Private company. Registered September 23rd. Capital £900. Objects: To carry on the business of electricians, mechanical engineers and manufacturers, and workers of and dealers in electricity, &c. The directors are: W. Emmett, 13, Southgate, Wakefield, and two others. Solicitors: Green & Williamson, Wakefield.

Argyll Manufacturing Co., Ltd.—Private company. Registered September 23rd. Capital, £10,000. Objects: To carry on the business of electricians, mechanical engineers and manufacturers and workers of and dealers in electricity, &c. The subscribers are: H. Shoosmith, 11, Curzon Road, Thornton Heath, Surrey; and S. F. Greg, 6, Regent's Park Road, N.W.1. Registered office: 52, Queen Victoria Street, E.C.4.

H. Brookes (Hanley), Ltd.—Private Company. Registered September 19th. Capital, £500. Objects: To carry on the business of manufacturers and repairers of and dealers in dynamos, motors, armatures, magnetos, batteries, &c. The directors are: H. A. Davies, 8, Kingsland Avenue, Oakhill, Stoke-on-Trent, and two others. Registered office: Meigh Street, Hanley, Stoke-on-Trent.

Carlisle Electrical Manufacturing Co., Ltd.—Private company. Registered September 24th. Capital, £2,000. Objects: To carry on the business of manufacturers, repairers and hirers of and dealers in electrical and mechanical apparatus and in particular radio sets and valves, gramophones, radio-gramophones, &c. The directors are: H. V. Carlisle, 25, Cavendish Road, Ellesmere Park, Eccles, and two others. Registered office: 30, Brown Street, Manchester.

R. B. & H. Harris, Ltd.—Private company. Registered in Dublin September 23rd. Capital, £15,000. Objects: To carry on the business of dealers in and suppliers of wireless sets and cabinets and equipment of all kinds for wireless transmission and reception, &c. The directors are: Anne Harris and H. Harris, both of 63, Leinster Road, Rathmines, Dublin; and Rachel Harris, address not stated.

C. G. Vincent, Ltd.—Private company. Registered September 22nd. Capital, £500. Objects: To carry on the business of manufacturers of and dealers in wireless and electrical components, fittings and parts, electric accumulators, and batteries, &c. The permanent directors are: E. G. W. Hounsom (chairman), Hilsom, Leigh Road, Cobham, Surrey, and C. G. Vincent, 114, Anyards Road, Cobham, Surrey. Registered office: 114, Anyards Road, Cobham, Surrey.

Electric Radio (Bristol), Ltd.—Private company. Registered September 25th. Capital, £100. Objects: To carry on the business of manufacturers of and dealers in wireless telegraphy, television and telephone apparatus and supplies and electrical, motor and automobile apparatus, &c. The directors are: Lady I. J. G. Brickwood, 29, Harley House, N.W.1, and two others. Registered office: De Montford Chambers, Taunton, Somerset.

Returns of Electrical Companies

Altrincham Electric Supply, Ltd.—Satisfaction to the extent of £80,000 on August 20th, 1936, of first mortgage debentures dated July 2nd, 1934, and registered July 3rd, 1936.

Tricity Cookers, Ltd.—Further charge dated September 15th, 1936, to secure £3,000 on all property charged by debenture dated January 22nd, 1935. Holders: Berry's Insulating & Building Products, Ltd., Wellington House, 125/130, Strand, W.C.2.

H. A. Birch & Co., Ltd.—Particulars filed of £1,500 debentures authorised August 27th, 1936, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £1,300.

Portman Electrical Engineering Co., Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated September 15th, 1936, to secure £500. Holder: G. Northcroft, 115, Harley Street, W.1.

Adelaide Electric Supply Co., Ltd.—Acknowledgment of indebtedness dated September 10th, 1936, supplemental to trust deed dated June 11th, 1918, and deeds supplemental thereto, to secure £200,000 4½ per cent. F consolidated debenture stock (Australian stock). Property charged: The company's undertaking in Australia (excluding dividend equalisation fund and uncalled capital). Trustees: Electrical and General Investment Company, Ltd.

Grimston Electric Tools, Ltd.—Capital, £7,500 in £1 shares. Return dated June 6th, 1936. 6,500 shares taken up. £2,778 16s. paid (£1 on 2,504, 2s. 6d. on 1,000 and 1s. on 2,996 shares). Mortgages and charges, £3,500.

Accumulators of Woking (1928), Ltd.—Capital, £10,000 in £1 shares. Return dated May 26th (filed June 4th), 1936. 8,501 shares taken up. £4,501 paid. £4,000 considered as paid. Mortgages and charges, £8,000.

Aidas Electric, Ltd.—Capital, £1,000 in £1 shares. Return dated May 30th, 1936. All shares taken up. £1,000 paid. Mortgages and charges, £7,500.

R. Darbyshire, Ltd.—Equitable charge on certain hire-purchase agreements, the full benefit thereof, all securities therefor, and all moneys payable thereunder, dated August 26th, 1936, to secure all moneys due or to become due from the company to Martins Bank, Ltd., not exceeding £1,000.

Hygienic Supplies (Accrington), Ltd.—The nominal capital has been increased by the addition of £1,500 in £1 ordinary shares, beyond the registered capital of £500.

Novo Radio (1935), Ltd.—The nominal capital has been increased by the addition of £500 in £1 ordinary shares, beyond the registered capital of £1,000.

C. F. Casella & Co., Ltd.—Capital, £17,000 in 2,000 preference and 15,000 ordinary shares of £1. Return dated August 14th, 1936. 2,000 preference and 12,204 ordinary shares taken up. £3,504 paid, £10,700 considered as paid. Mortgages and charges nil.

Urban Electric Supply Co., Ltd.—Capital, £1,050,000 in £1 shares (700,000 ordinary and 350,000 preference). Return dated May 11th, 1936. All shares taken up. £675,025 paid on 425,025 ordinary and 250,000 preference. £374,975 considered as paid on remainder. Mortgages and charges, nil.

Yorkshire Electric Transformer Co., Ltd.—Capital, £10,000 in 2,500 preference and 7,500 ordinary shares of £1. Return dated June 6th, 1936. 600 preference and 5,407 ordinary shares taken up. £6,007 paid. Mortgages and charges nil.

Meifod Electricity Co., Ltd.—Capital, £100 in 400 shares of 5s. Return dated May 29th, 1936. 40 shares taken up. £10 paid. Mortgages and charges: £1,100.

Teignmouth Electric Lighting Co., Ltd.—Capital, £80,000 in £1 shares. Return dated May 1st, 1936. 70,000 shares taken up. £69,500 paid, £500 considered as paid. Mortgages and charges nil.

Julians of Reading, Ltd.—Capital, £5,000 in £1 shares. Return dated May 12th, 1936. 2,403 shares taken up. £2,403 paid. Mortgages and charges: £5,250.

Anglo Swiss Electrical Co., Ltd.—The nominal capital has been increased by the addition of £100, in £1 ordinary shares, beyond the registered capital of £500.

London Electronics (Machinery), Ltd.—The nominal capital has been increased by the addition of £5,000 beyond the registered capital of £35,000. The additional capital is divided into 5,000 6 per cent. preference shares of £1 each.

Colne Valley Electric Supply Co., Ltd.—The nominal capital has been increased by the addition of £30,000 in £1 ordinary shares beyond the registered capital of £160,000. The additional capital is divided into 30,000 ordinary shares of £1. At July 23rd, 1936, the Electrical Finance & Securities Co., Ltd., held 159,921 shares out of 160,000 issued.

Northwood Electric Light and Power Co., Ltd.—The nominal capital has been increased by the addition of £50,000 in £1 ordinary shares beyond the registered capital of £90,000. At July 23rd, 1936, the Electrical Finance & Securities Co., Ltd., held 81,531 ordinary shares out of 6,880 preference and 83,120 ordinary shares issued.

Lancashire & Cheshire Twinlamp Co., Ltd.—The nominal capital has been increased by the addition of £2,000 beyond the registered capital of £3,000. The additional capital is divided into 2,000 7½ per cent. cumulative preference shares of £1 each.

Pioneer Private Telephone Co., Ltd.—The nominal capital has been increased by the addition of £20,000 beyond the registered capital of £6,500. The additional capital is divided into 20,000 7½ per cent. cumulative preference shares of £1 each.

City Notes

Murex, Ltd., is paying a final ordinary dividend of 15 per cent. (against 10 per cent.), making the total distribution for the year of 25 per cent.. as compared with 20 per cent. for the previous year. The company states that the business has again showed considerable expansion, and extensive additions to factory premises and plant are under construction to meet the increased demand. Additional cash will be required for this purpose, and the directors have decided to issue the 46,500 ordinary shares at present unissued, thus raising the issued ordinary capital to £600,000. A total of 46,125 ordinary shares will be offered to holders in the ratio of one for every twelve shares held at £6 10s. per share. The remaining 375 shares, together with shares resulting from rights not exercised, will be offered on the same terms to members of the operating staff, the shares to rank for dividend as from July 1st, 1936. As the nominal value of the shares in issue does not represent the money actually employed in the business, the board feels that the share capital should be brought more nearly into line with the money which has been contributed by the shareholders. As soon as the final instalment of the new issue has been paid, resolutions will be submitted for increasing the authorised capital to £1,250,000 by the creation of 600,000 ordinary shares of £1 each, and for capitalising reserves of £400,000 by the allotment and issue as bonus shares of 400,000 of the new ordinary shares in the proportion of two bonus shares for every three held. The new shares will rank for dividend as from July 1st, 1936. The annual meeting will be held on October 15th.

J. & F. Stone Lighting & Radio, Ltd., reports a profit for the year ended June 30th, after providing £6,000 for amortisation of leases and depreciation of fixtures, of £50,682, which with £1,265 brought in makes £51,948 available. Tax reserve receives £7,000, and £10,000 is written off preliminary and formation expenses. As announced in our last issue, the final ordinary dividend is 7½ per cent., making 12½ per cent. for the year (against 10 per cent.), and £3,681 is carried forward. The annual meeting will be held on October 19th and will be followed by an extraordinary meeting at which resolutions will be submitted for increasing the capital to £600,000 by the creation of 115,000 6 per cent. cumulative redeemable preference shares of £1 and 740,000 ordinary shares of 5s. each.

The British Columbia Power Corporation reports a gross revenue for the year ended June 30th of $13,950,956, an increase of $920,865, as compared with the preceding year. From this are deducted expenses, taxes, depreciation, bond interest and discount, cost of exchange and preference dividends, leaving $1,641,941 net. After providing for dividends on class "A" shares there is a surplus of $91,941. The load building activities of the merchandising and sales departments have brought about increases in light, power and gas revenues. Electric services totalling 3,121 were added, the commercial load being increased by 4,800 h.p.

The India Rubber, Gutta Percha & Telegraph Works Co., Ltd., has decided to pay the following dividends:—2¾ per cent., less tax, on the 5½ per cent. preference shares for the half-year ended September 30th; the fixed dividend of 6 per cent., less tax, on the preferred ordinary shares, plus an interim of 2 per cent., less tax, for the year ended September 30th (against 6 per cent.); and the fixed dividend of 6 per cent., less tax, plus an interim dividend of 3 per cent., on the ordinary shares (last year 6 per cent.).

Electric & Musical Industries, Ltd., announces that, subject to audit, the profit for the year ended September 30th last amounts to £266,739, as compared with £451,002 in the preceding year, when there was also added £114,544 on the sale of investments, making £565,546. It is proposed to pay an ordinary dividend of 10 per cent. for the year, against a dividend of 10 per cent. and a bonus of 2½ per cent. for the previous year.

The Sun Electrical Co., Ltd., reports net profits for the year ended April 30th last of £17,523 (as compared with £20,093 in the preceding year), to which is added £4,131 brought in, making £21,654. The ordinary dividend for the year is 5 per cent. (against 6 per cent.), and £3,613 is carried forward.

Stothert & Pitt, Ltd., recommend a dividend of 7½ per cent. on the ordinary shares for the year ended June 30th. No ordinary distribution was made for the previous four years. Reserve is to be increased by £20,000.

Parkinson & Cowan, Ltd., are paying a dividend of 3½ per cent., less tax at 4s. 9d., in respect of arrears on the 7 per cent. preference shares for the half-year ended September 30th, 1935.

Joseph Lucas, Ltd., are paying a final ordinary dividend of 12½ per cent. (against 10 per cent.), making 15 per cent. for the year, as compared with 12½ per cent. for the previous year.

Burco, Ltd.—Subscription lists for the offer for sale of 280,000 ordinary shares of 5s. each at 10s. per share were to be opened to-day (Friday).

The Electrical Finance & Securities Co., Ltd., is maintaining its interim ordinary dividend at 5 per cent. (less tax).

The Salisbury Electric Lighting & Supply Co., Ltd., is maintaining the interim dividend at 4 per cent.

The Calcutta Tramways Co., Ltd., has declared an interim ordinary dividend of 3 per cent., less tax (against 3½ per cent.).

Stocks and Shares

TUESDAY EVENING.

STOCK EXCHANGE markets have been moving in somewhat erratic fashion as a consequence of the French decision to devalue the franc. More important still was the simultaneous announcement that agreement on the principal heads surrounding foreign exchange had been reached by France, the United States and this country; a decision which will have a far-reaching effect and which is regarded as being one of the most important steps taken of recent years towards the furtherance, not only of international commerce, but of amity as well. Stocks and shares in companies connected with the French investor have mostly fallen in price: those concerned with gold and other metals are, generally speaking, better. The prospect of revival of trade between the nations has resulted in activity and better prices for sterling securities likely to be affected by international considerations.

That everything is not yet over save the shouting, is so generally acknowledged that little runaway has occurred in prices, with one or two exceptions. It is recognised that a number of doubts have to be resolved before the full effect of the developments can come into play, but the more hopeful tone inspired by expectation of general trade conditions becoming brighter, is apparent in most of the markets round the Stock Exchange.

Gilt-edged Securities

First effects, in the London Stock Exchange, of the French currency decision were, naturally, the result of the adjustment of positions entered into during the previous period. Devaluation of the franc is thought likely to attract back to its own country a fair proportion of the French money which has been seeking sanctuary in British and American securities. The safety offered by investment in British Government and other gilt-edged stocks has, of course, long acted as a powerful magnet for French capital unable to rest easily among the economic anxieties of its own country. The possibility of realisations on a heavy scale of "foreign" stocks by French holders anxious to repatriate their money, caused an immediate and fairly sharp marking-down of prices in the gilt-edged market The set-back was due more to precautionary measures taken by the market than to pressure of selling, and a partial rally promptly occurred. The movement is not expected to make any material headway, having regard to the prevailing cheap monetary conditions. Indeed, it is held in some quarters that, freed from the uncertain movements of French funds, the authorities will be able to pursue the policy of cheap money with greater freedom than before.

Cable and Wireless

Hopes that the latest currency measures will help to lubricate the wheels of international trade, found speedy expression in sharp rises in Cable and Wireless stocks, the "A" ordinary gaining 1½ points to 22, the "B" ordinary ½ to 6¼, and the preference ½ to 101½. Assuming that the optimism is justified, the movement is natural enough; few companies, except, perhaps, those engaged in shipping, stand to gain more from freer intercourse between nations. An advance of $\frac{1}{16}$ in the price of Marconi Marines reflects similar

hopes, viewed from the shipping standpoint. Globe Telegraphs are, surprisingly, ⅛ down, at 13⅞.

Great Northern Telegraphs were depressed by fears that the currency readjustments might react in a manner detrimental to the company. American communication stocks show some substantial gains; American "Tel. and Tel." spurted from 172½ to 177½, and Internationals from 11⅜ to 12⅞.

Electrical Equipment Shares

Except in particular cases, little disturbance in industrial share-markets followed the franc decision. The particular cases mentioned include the shares of those companies which rely to a large extent on foreign trade, and which may suffer from the competition of foreign rivals, now able to trade on better terms than previously. Taking the longer view, however, it can be said that, as a step towards better international relationships, the measure is a favourable factor for industrial issues.

Shares in the equipment group make a good showing, with a few falls of which 2s. 3d. in Johnson and Phillips is one of the principal. On the other hand, Ericssons are a good market, with a rise of 7/16 to 2⅝. British Insulated have gained ⅛ to 5⅜, Callenders and Enfield Cables 1/16 each at 4 5/16 and 5 13/16 respectively. Cromptons have been moving jerkily, advancing to 4¼ before going back to 4⅛, at which the price shows no net change. British Aluminium continue dull, and at 41s. are a further 6d. easier.

Electric and Musical Industries

According to the preliminary statement, profits of Electric and Musical Industries fell, during the past year, from £451,000 to £267,000. On these figures, it seems that the cut in the dividend rate from 12½ per cent. (including 2½ per cent. bonus) to 10 per cent. might well have been a more severe one. The pessimists were, indeed, prepared to receive no more than 7½ per cent. The 10 p.c. dividend will swallow up available profits to the hilt; the Board's policy is, on that evidence, a sign of confidence in the company's powers of recovery. A good deal is probably expected from extension of the company's activities into the fields of television, refrigerators and other domestic accessories.

A steady decline in the price of E. M. I. shares from this year's highest point of over 29s. to the present price of 21s. 9d. shows clearly enough that a set-back in the dividend had been anticipated. The extent of the cut being no worse than the market's general estimate, the actual announcement made little impression on the price of the shares. The present yield works out at 4.6 per cent.

British Columbia Power

Higher expenses in the form of operating costs and taxation, largely offset a 7 per cent. increase in the total revenue of the British Columbia Power Corporation during the past year. Nevertheless, while the gross figure is still well short of the peak level of 1930, the revival which began in 1934 is maintained.

The company's capital is divided into "A" and "B" shares, each of no par value; there is a fairly free market in this country for both classes of shares, the "A" being dealt in, at present, around $32, and the "B" around $4. The "A" shares are entitled to a non-cumulative annual dividend of $2 per share in priority to the "B" shares, after which they participate equally with the "B" shares up to a further $3 per share. They are redeemable at $100 per share at any time.

No dividend has yet been paid on the "B" shares. The "A" received quarterly dividends at the rate of $2 per annum, until October, 1933, after which the rate was dropped to $1¼ per annum. The last two quarterly distributions were slightly higher at 40 cents. each.

Electricity Supply Shares

Prices in the market for shares in the electricity supply companies are very firm. Clyde Valley and Electrical Distribution of Yorkshire ordinary are both better. Calcutta Electrics have risen 1s. 9d. to 57s. 9d. East Africans firmed up to 32s. 6d. Atlas are better at 7s. Palestine "A" at 51s. 6d. have put on nearly a florin. It may be of service to suggest to holders of debenture stocks in electricity companies that they should study the terms of redemption attached to their securities. In some cases, the companies have the right to repay their debenture stocks within a comparatively short time, and at prices well under those now current in the Stock Exchange market, a situation which may result in loss to holders.

Miscellaneous Matters

Brazilian Tractions jumped into favour on the prospect of a relaxation in South American currency restrictions, and of greater ease in transferring funds out of the country for the distribution of available profits to foreign shareholders. The price of the shares, at 14, shows a gain of 1½. The recent cash distribution of 30 cents. per share showed that improvement in the exchange position was already under way before the events of last week-end. Babcock & Wilcox are dull at 50s. on prospects of possible foreign competition, a consideration that has introduced mild dullness into shares of other companies engaged in the "heavy" industries. Rubber shares have strengthened in a few cases, notably those in concerns operating in the Dutch colonies.

Share List of Electrical Companies

Home Electricity Companies.

	Nom.	Dividend. Previous.	Last.	Price. Sept. 29.	Rise or Fall.	Yield p.c. £ s. d.
Bournemouth and Poole	1	15	15	77/6	—	3 17 5
City of London	1	7½	7½	37/–	—	4 1 1
Clyde Valley	1	7	8	47/–	+6d.	3 8 1
County of London	1	10½	10½	55/–	—	3 16 4
Edmundson's 7% Pref.	1	7	7	35/6	—	3 19 0
Do. Ord.	1	8	8	45/–	—	3 11 0
Elec. Dis. Yorkshire	1	9	9	48/–	+6d.	3 15 0
Elec. Fin. and Securities... ...	1	12½	12½	3½	—	4 0 0
Elec. Supply Corporation ...	1	11	11	60/9	—	3 12 4
Lancs Light and Power	1	7½	7½	38/–	—	3 19 0
Lond. Assoc. Electric	1	—	7	35/–	—	4 0 0
London Electric	1	7	8	39/6	—	4 1 1
London Power Deb. Red. ...	Stock	5	5	107½	—	4 13 0
Metropolitan	1	10	10	51/–	—	3 18 5
Midland Counties	1	7	7½	41/6	—	3 12 2
Mid. Elec. Power	1	8	8	45/–	—	3 11 1
North Eastern Electric Ordinary	1	6	6	35/6	—	3 7 7
Do. 7% Pref.	1	7	7	36/–	—	3 17 9
Northampton	1	10	10	51/3	—	3 18 2
Notting Hill 6% Pref.	10	6	6	14½	—	4 4 3
North Met. Elec. Ordinary ...	1	10	10	58/3	—	3 8 7
Do. do. 6% Pref. ...	1	6	6	32/6	—	3 13 10
Scottish Power	1	8	8	42/–	—	3 16 2
South London	1	7	7	34/6	—	4 1 2
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	22/–	—	6 16 4
Yorkshire Elec.	1	8	8	44/–	—	3 12 9

Public Boards.

Central Electricity, 1960–70 ...	Stock		5	116½	—	4 5 9
Do. 1955–75 ...	„	5	5	118½	—	4 4 4
Do. 1951–73 ...	„	4½	4½	111½	—	4 0 9
Do. 1963–93 ...	„	—	3½	104	—	3 7 4
London Elec. Trans. Gtd. ...	„	—	2½	96	—	2 12 1
London & Home Counties, 1955–75	„	4½	4½	114	—	3 19 0
London Passenger Transport, A...	„	—	4½	126½	+1	3 11 2
Do. do B...	„	—	5	128½	—	3 17 10
Do. do C...	„	3½	4	107	—	3 14 9
West Midlands Joint Elec. 1948–68	„	—	5	115½	—	4 6 7

Telegraph and Telephone.

American Tel. & Tel.	$100	9	9	177½	+5	5 1 4
Anglo-Am. Tel. Pref.	Stock	6	6	128½	—	4 13 5
Do. Def.	„	1½	1½	32	—	4 13 9
Cable & Wireless 5½% Pref. ...	„	4½	5½	101½	+½	5 8 5
Do. A. 7½% Ord.	„	Nil	Nil	22	+1½	—
Do. B. Ord.	„	Nil	Nil	6½	+½	—
Globe Tel. & Tel. Ord.	10	3½*	4½*	13⅞	−⅛	3 4 10
Do. Do. Pref.	10	6	6	14½	—	4 4 3
Great Northern Tel.	10	20	20	42½	−4½	4 14 1
Marconi-Marine	1	10	7½	36/3xd.	+1/8	4 2 9
Oriental Telephone Ord.	1	12*	12*	3½	—	3 13 10

Home and Foreign Trams, etc.

Anglo-Arg. Trams First Pref. ...	5	Nil	Nil	1/–	—	—
Do. do. 2nd Pref.	5	Nil	Nil	9d.	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	5	—	—
British Electric Traction Df. Ord.	„	5	5	1525	—	—
Do. do. Pref. Ord.	„	8	8	177½	+2	4 10 2
Brazil Traction	100	—	30 cts	14	+1½	—
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	104½	—	4 15 8
Mexican Light Common	100	Nil	Nil	3½	—	—
Do. 1st Bonds	$500	5	5	45	—	—
Victoria Falls Ord.	1	20	12	3 11/16	—	3 3 0
West Riding	1	5	6½	50/–	—	2 12 9

Manufacturing Companies.

Aron Electricity Ord.	1	10	15	63/9	—	4 14 1
Assoc. Elec. Ord.	1	6	8	52/0	—	3 1 6
Do. Pref.	1	8	8	39/6	—	4 1 0
Babcock & Wilcox	1	8	8	50/–	−1/8	3 4 0
British Aluminium Ord.	1	7½	7½	41/–	−6d.	3 13 2
British Insulated Ord.	1	15	20	5⅜	+⅛	3 11 2
Brush Ord....	Stock	Nil	Nil	35	—	—
Callender's	1	15	15	4 5/8	+1/8	3 5 8
Do. 6½% Pref.	1	6½	6½	32/6	—	4 0 0
Crompton Parkinson Ord. ...	5/–	—	12½	4½	—	—
Do. 8% Pref.	1	8	8	2	—	4 0 0
Edison Swan 1st Pref.	1	7½	7½	30/–	—	5 0 0
Electric Construction	1	3½	7	40/–	—	3 10 0
Enfield Cable Ord.	1	25	25	5 13/16	+1/8	4 7 0
English Electric	1	Nil	Nil	27/–	—	—
Do. Do. Pref.	1	Nil.	Nil	27/6	—	—
Ericsson Tel.	5/–	24	20*	2⅞	+1/8	1 14 9
Ever Ready	5/–	35	35	27/3	+9d.	6 8 8
Ferranti Pref.	1	7	7	28/9	—	4 17 5
G.E.C. Pref.	1	6½	6½	35/–	—	3 14 4
Do. Ord.	1	10	15	91/–	−6d.	3 6 0
Henleys	1	30	30	7½	—	4 1 4
Do. 4½% Pref.	5	4½	4½	5⅛	—	3 18 3
India-Rubber Preferred	1	—	5½	1½	—	4 17 9
Johnson & Phillips	1	7½	10	52/–	−2/3	3 16 9
Lancashire Dynamo	1	5	10	3	—	3 6 8
Siemens Ord.	1	4	6	32/6	—	3 13 10
Telegraph Construction	£1	Nil	Nil	33/9	—	—

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be numbered and abridged and all subsequent proceedings will be taken.

1934

26319. "Electric batteries." A. H. Redfern and F. MacCallam. December 13th, 1934. (452974.)

34017. "Electrical arrangements for controlling electric lamps of a lamp screen adapted to reproduce pictures." Reklamaktiebolaget Epok and W. W. Triggs. November 26th, 1934. (Addition to 432501.) (Convention date not granted.) (452859.)

1935

2678. "Transformers of the oil-immersed type." J. L. Rowbotham, E. Billig and Hackbridge Electric Construction Co., Ltd. January 26th, 1935. (452864.)

3387. "Electron-discharge devices." Marconi's Wireless Telegraph Co., Ltd. February 1st, 1934. (453121.)

6510. "Electrical warming and electrical serving of buildings." T. G. Partridge. March 1st, 1935. (452923.)

6531. "Dry-contact rectifiers." Standard Telephones & Cables, Ltd., R. J. Elsome-Jones and L. J. Ellison. March 1st, 1935. (452925.)

6532. "Multi-conductor electric telephone cables for carrier-current communication." Standard Telephones & Cables, Ltd., E. Baguley and A. L. Long. March 1st, 1935. (453124.)

6560. "Electrical relay and oscillator systems." Marconi's Wireless Telegraph Co., Ltd. March 1st, 1934. (452927.)

6596. "Electric battery lamps." C. W. Gray. March 2nd, 1935. (453125.)

6808. "Television and like receivers." Marconi's Wireless Telegraph Co., Ltd., and A. A. Linsell. March 4th, 1935. (453135.)

6809. "Television and like apparatus." Marconi's Wireless Telegraph Co., Ltd., H. M. Dowsett and L. E. Q. Walker. March 4th, 1935. (453136.)

6810. "Electron-discharge device amplifier and like arrangements." Marconi's Wireless Telegraph Co., Ltd., G. M. Wright, G. F. Brett and N. M. Rust. March 4th, 1935. (453137.)

6811. "Modulated carrier-wave receivers." Marconi's Wireless Telegraph Co., Ltd., and A. T. Witts. March 4th, 1935. (453138.)

6906. "Tuning indicators for wireless or like receivers." General Electric Co., Ltd., S. G. Hunter and W. H. Peters. March 5th, 1935. (453140.)

6930. "Electric insulators." Bullers, Ltd., and H. C. R. Dagnall. March 5th, 1935. (453143.)

6951. "Electric synchronising apparatus." A. Reyrolle & Co., Ltd., and H. Leyburn. March 5th, 1935. (453146.)

7005. "Magneto-electric machines." N. Cooke. March 6th, 1935. (453152.)

7006. "Electrolytic condensers." Dubilier Condenser Co. (1925), Ltd., and N. C. Moore. March 6th, 1935. (453058.)

7041. "Indirectly heated cathodes for thermionic valves." Standard Telephones & Cables, Ltd., and F. D. Goodchild. March 6th, 1935. (453154.)

7047. "Speed control systems for electric generating plant driven by an internal-combustion engine." English Electric Co., Ltd., and P. L. Mardis. March 6th, 1935. (453207.)

7181. "Interlocked electric switches." British Thomson-Houston Co., Ltd., D. H. Graham, H. J. Taylor and E. Sayers. March 7th, 1935. (453158.)

7196. "Switching devices for standard and like electric lamps." F. Ferris. March 7th, 1935. (453160.)

7408. "Electric-lamp holders." N. Dennes and Metropolitan-Vickers Electrical Co., Ltd. March 9th, 1935. (453162.)

7549. "Method of testing the emission of thermionic valves." E. R. Sawyer. March 11th, 1935. (453167.)

7663. "Speed-regulating devices for electric motors." Electrical Apparatus Co., Ltd., R. H. Barbour and J. R. Walton. March 12th, 1935. (452985.)

7808. "Two-part electrical couplings." Carr Fastener Co., Ltd., and C. W. Oliver. March 13th, 1935. (453168.)

9384. "Aircraft landing-lights." General Electric Co., Ltd., E. L. B. Damant and W. A. Villiers. March 26th, 1935. (452933.)

11656. "Commutators for dynamo-electric machines." A. Allison. April 15th, 1935. (453067.)

12350. "Electric heating devices, more particularly for use with soldering irons." General Electric Co., Ltd., and W. H. Grafton. April 24th, 1935. (452937.)

13449. "Microphones." A. Graham & Co., Ltd., and C. H. Vaughan. May 7th, 1935. (453068.)

13460. "Electrical screening devices." V. Dumert. May 7th, 1935. (452881.)

13899. "Electric circuit-breakers." D. R. Davies and Metropolitan-Vickers Electrical Co., Ltd. May 11th, 1935. (452997.)

14290. "Electric transformers and chokes." B. J. Legg and W. S. Miller, jun. May 16th, 1935. (Cognate application, 22758/35.) (453000.)

14457. "Cycle dynamos." Raleigh Cycle Co., Ltd., and A. V. Lafbery. May 17th, 1935. (452940.)

15917. "Boxes for metallic electrical conduits." J. E. S. E. Honor and C. W. H. Honor. May 31st, 1935. (453006.)

18689. "Reversing electric switches or controllers." Hopkinsons, Ltd., R. L. Brown and W. B. Dale. June 29th, 1935. (452947.)

18317. "Rheostatic braking systems for electrically driven vehicles supplied through grid-controlled rectifiers." British Thomson-Houston Co., Ltd. June 30th, 1934. (452948).

19288. "Electrodes for electric-discharge devices." British Thomson-Houston Co., Ltd., T. F. Smeaton, W. J. Scott and H. de B. Knight. July 5th, 1935. (453074.)

19384. "Electrical selector systems." M. D. Sarbey. July 6th, 1935. (452888.)

19683. "Relaxation oscillation generators." Radio Akt.-Ges. D. S. Loewe. July 20th, 1934. (Addition to 423394.) (453011.)

20392. "Rotary type electrical controllers." C. T. Scarf, C. H. Last and Metropolitan-Vickers Electrical Co., Ltd. July 17th, 1935. (452951.)

21015. "Systems for supplying electric power and heating-steam." Chance Bros. & Co., Ltd., A. J. W. Wise, and L. B. H. Hallett. July 24th, 1935. (453075.)

21032. "Decorative artificial lighting." A. H. Brackensey and Franco-British Electrical Co., Ltd. July 24th, 1935. (453014.)

21381. "Electron-discharge devices." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). July 27th, 1935. (Convention date not granted.) (452890.)

21615. "Insulating materials suitable for covering electric conductors." British Thomson-Houston Co., Ltd. July 30th, 1934. (453015.)

21705. "Electric battery lamps." J. N. Bailey (C. T. Yu.). July 31st, 1935. (453016.)

24380. "Self-starting low-speed synchronous motors." O. Janzen. September 29th, 1934. (453022.)

26986. "Electric switching apparatus employing conductive liquids." Siemens-Schuckertwerke Akt.-Gas. November 2nd, 1934. (453080.)

27013. "Electric cable dielectrics." Compagnie Générale d'Electricité. October 8th, 1934. (452894.)

29374. "Current reversing switches for dynamo-electric machines supplying a storage battery and a consumer system." Scintilla Akt.-Ges. October 25th, 1934. (453032.)

30122. "Electric supply meters." British Thomson-Houston Co., Ltd. November 1st, 1934. (453033.)

32211. "Magnetron circuit arrangements." Telefunken Ges. für Drahtlose Telegraphie. November 30th, 1934. (452960.)

32421. "Cooling of dynamo-electric machines." W. Alden. December 22nd, 1934. (453038.)

1936

2836. "Cathode-ray tube television and like reproducer apparatus." Telefunken Ges. für Drahtlose Telegraphie. January 30th, 1935. (453043.)

3625. "Electric battery lamps." J. N. Bailey (C. T. Yu). July 31st, 1935. (Divided out of 453016.) (453044.)

3935. "Devices for generating a voltage increasing linearly with time." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. April 18th, 1935. (452965.)

6313. "Electron-discharge devices and holders therefor." Marconi's Wireless Telegraph Co., Ltd. March 6th, 1935. (452907.)

8349. "Radio receivers." Ideal Werke Akt.-Ges. für Drahtlose Telephonie. March 23rd, 1935. (453103.)

10150. "Electric transformers." British Thomson-Houston Co., Ltd. April 6th, 1935. (453106.)

10852. "Electric welding equipment." British Thomson-Houston Co., Ltd. April 15th, 1935. (Addition to 2061/36.) (452971.)

16506. "Multi-conductor electric telephone cables for carrier-current communication." Standard Telephones & Cables, Ltd., E. Baguley and A. L. Long. March 1st, 1935. (Divided out of 453124.) (453198.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from September 23rd:—

Escura. No. 568823. Class 8. Electric discharge lamps (not for surgical or curative purposes, and not being ordinary electric incandescent lamps).—Edison Swan Electric Co., Ltd., 155, Charing Cross Road, W.C.2.

Nudisco. No. 570896. Class 13. Electric lamps (ordinary), lampholders, reflectors, fittings, brackets, ordinary electric switches, lamp sockets and parts thereof.—NuDisplay, Ltd., Mansfield House, Southampton Street, W.C.2.

Automatic Control in Industry

PROMINENT scientists, engineers and industrialists from all parts of the country will take part in what is probably the first conference of its kind on automatic control in industry to be held at University College, London, on October 15th and 16th. The conference has been organised by the Chemical Engineering Group of the Society of Chemical Industry, and among the papers which will be read and discussed are the following:—

Thursday, October 15th, afternoon session (3 to 5 p.m.).—"Electrical Control of Chemical Apparatus," by A. D. Elmsly Lauchlan, of the Cambridge Instrument Co.; and "Simple Forms of Automatic Regulators," by Dr. Ezer Griffiths, of the National Physical Laboratory.

Evening session (6 to 8 p.m.).—"The Installation Factor in Automatic Controls," by Douglas Harrison, of Negretti and Zambra; and "The Application of Automatic Control to a Typical Problem in Chemical Plant," by A. Callender and A. B. Stevenson, of I.C.I. (Alkali), Ltd.

Friday, October 16th, afternoon session (3 to 5 p.m.).—"Some Aspects of the Technical Application of Temperature Control," by B. T. Wingfield, of the Drayton Regulator and Instrument Co., Ltd.; "Automatic Control for Temperature and Pressure in Chemical Industry," by W. J. A. Copeland, of the Lovick Johnson Co.; and "Automatic Control of Chemical Processes," by Dr. W. A. Clark, of I.C.I. (Fertiliser and Synthetic Products), Ltd.

Evening session (6 to 8 p.m.).—"The Influence of the Characteristics of a Plant on the Performance of an Automatic Regulator," by Dr. A. Ivanoff, of George Kent, Ltd.; and "Experience of the Use of Instruments as Aids to Plant Control," by J. Frisken and E. I. Lowe, of the National Smelting Co., Ltd.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Abram (NEAR WIGAN).—Houses (36), Bickershaw; W. H. Roby, U.D.C. surveyor, Council Offices.

Altrincham.—Houses (38), Craven Road; H. E. Brown, U.D.C. surveyor, Town Hall.

Aylesbury.—Extensions to works, for the Aylesbury Battery Service Co., Havelock Street.

Bexhill-on-Sea.—Block of 24 flats, De La Warr Parade, for Baskerville Court, Ltd.; Mr. Hamilton, architect.

Birmingham.—Houses (514) and maisonettes, Lea Hall estate, Stechford; H. J. Manzoni, city surveyor, Council House. Offices, for the British Broadcasting Corporation. Additions, Docker Bros., Rotten Park Street, Edgbaston (£25,000), with electrical work; Whitehouse & Son, builders, Monument Road, Birmingham.

Blackburn.—Houses (75), St. Aidan's Avenue, Mill Hill; Midland Modern Homes, Ltd., 66, Wigan Road, Bolton.

Bollington.—Extensions to Rock Bank Mills; Fine Cotton Spinners' & Doublers' Associations.

Bradford.—Buildings for the Board of Governors of St. Bede's Grammar school, Heaton Hall; C. Simpson, 12, Cunliffe Terrace, Cunliffe Road, Bradford.

Brentford.—Extension to factory, Great West Road; Macleans, Ltd.

Brighton.—Church, East Moulsecoomb estate; Rev. R. M. Wilson, secretary, Sussex Church builders.

Bristol.—Houses, Knowle estate and Horfield estate; city surveyor, 51, Prince Street.

Bromley (KENT).—Business stores, High Street, for Boots, Ltd., chemists, Nottingham.

Burnley.—Senior school, for Borough E.C.; borough surveyor.

Castle Douglas (KIRKCUDBRIGHTSHIRE).—Houses (26), electrical work; M. Purdon Smith, architect, 95, Irish Street, Dumfries.

Chester.—Houses (24), Broadway, Blacon; T. B. Gorst & Sons. School, Newton (£23,538); city engineer.

Clydebank.—Factory, for J. Brockhouse & Co., Ltd., West Bromwich.

Coventry.—Houses (170), Radford estate (£69,570); city engineer.

Dartford.—Municipal offices (£87,000); D. G. Walton, architect, Birmingham.

Easington.—Houses (399), in connection with clearance scheme; Hays and Gray, architects, Central Chambers, Wingate.

Edinburgh.—Mill and warehouse (first part of £250,000 scheme), for British Ropes, Ltd., Bath Street, Leith.

Egham.—Houses (32), West End estate, Englefield Green; J. Gerrard & Sons, Ltd., builders.

Glasgow.—Fire station, Mingarry Street, Kelbourne Street and Sand Street (£70,000); city engineer.

Grimsby.—Nurses' home, Bracebridge Hospital (£36,000); borough engineer.

Hanley.—Factory, Clough Street; Alcock, Lindley & Bloore.

Harpenden.—Bazaar stores, High Street, for F. W. Woolworth & Co., Ltd., London.

Hereford.—Alterations and extensions to Imperial Hotel; H. E. Bettington, architect, 12, Castle Street.

Holywell.—Houses (54), Saithaelwyd; Boultons (Bebington), Ltd., Stonehill Avenue, Old Chester Road, Bebington.

Ilford.—Houses (100), Herent Drive; Lord & Mellodew, Ltd., Longbridge Road, Barking. Houses (64) and shops and flats, near New North Road; Davis Estates, Ltd. Cinema and shops, Fulwell Cross; Mr. Coles, architect. Library, Gantshill; borough engineer. School, Dr. Barnado's Homes; Wratten & Godfrey.

Keighley.—Houses, Bankfield Road; T. A. Lister. Houses (20), Carforth Road; J. Rishworth.

Kettering.—Junior school, Windmill Avenue, for E.C. Enlargement of fire station; U.D.C. surveyor.

Kingston-on-Thames.—Extensions to works, for Hawker Aircraft, Ltd., Canbury Park Road.

Kirkcaldy.—Municipal buildings; Sir John Burnet, Tait and Lorne, 1, Montague Place, London, W.C.1.

Lancashire.—Grammar school, Ashton-in-Makerfield, and senior school, Penketh, for County E.C.; S. Wilkinson, county architect, Preston.

Lanchester.—Houses (374), in connection with slum clearance scheme; R.D.C. surveyor.

Leamington.—Station (£50,000), for Great Western Railway Co.; chief engineer, Paddington, London, W.2.

Llanrwst (DENBIGHSHIRE).—Houses (26), Cae Person; U.D.C. surveyor.

London.—(BATTERSEA).—School, Linda Street; L.C.C. architect. (POPLAR).—Central garage, Glaucus Street (£18,720); borough engineer. Extensions to works, Bedford Street; Commercial Properties, Ltd., 14, West Smithfield, E.C.1. Extensions to Chrisp Street premises; F. W. Woolworth & Co., Ltd.

Lowestoft.—Development of Grove Farm estate, Pakefield; C. Hadenham. Extensions to London Road premises; F. W. Woolworth & Co., Ltd.

Luton.—Factory, for the Percival Aircraft Co., Ltd.

Macclesfield.—Extensions, Backhouse & Coppock, Ltd., Sutton Mill.

Manchester.—Additions to works, for Small & Parkes, Ltd.; Hendham Vale works, Collyhurst; H. S. Fairhurst & Son, architects, Chancery Chamber, 55, Brown Street, Manchester.

Mansfield.—Houses (34), Skegby Lane; A. Farnsworth.

Martley (WORCESTERSHIRE).—Houses (40); R.D.C. surveyor.

Middlesbrough.—Additions to premises, for W. Shaw & Co., Ltd., Ayrsome Back Street; staff architect.

Morecambe.—Houses (22), Bateman Road; Coates & Flaxington. Houses (28), Draycombe Drive; Swithenbank & Ladell. Houses (28), Lowlands Road; A. Whitehead. Cinema, Heysham Road; Mr. Graham.

Newbury.—Extensions to Abbey Road works; Elliotts, Ltd.

Newcastle-on-Tyne.—Alterations to 28-30, Shields Road, for Scallon Brothers; Marshall & Tweedy, architects, 129, Pilgrim Street.

Normacot (STAFFORDSHIRE).—Houses (100), Meir Road; Hillside Housing Estate Co.

North Shields.—Extensive alterations to the Ballarat Hotel; Chisholm & Co., builders, Upper Reed Street.

Northumberland.—Extensions to Council school, Cramlington, for C.C.; county architect, County Hall, Newcastle-on-Tyne.

Norwood.—Houses (160), Beulah Hill estate; F. T. Wooding & Sons, Ltd.

Okehampton.—Cinema, St. James's Street, for W. E. Pope (electrical work).

Orrell.—Houses and bungalows (10¼ acre site), Bell Lane; A. W. Charity, U.D.C. surveyor, Council Offices, Orrell Road, Orrell.

Oxford.—School, Milnham Ford (£53,000), for City E.C.; Ephraim Organ & Son, builders.

Romford.—Cinema, electrical work, Gallows Corner, Gidea Park, for Bernstein Theatres, Ltd.; S. L. Bernstein.

Rugby.—Houses (1,000), Bilton, for Overslade Estates, Ltd.; W. T. Loveday, architect.

St. Albans.—Houses (40), near Hatfield Road, for Penbright Estates, Ltd.

Scunthorpe.—Additions to buildings and laundry (£25,000), for the Board of Governors of the War Memorial Hospital (A. E. Maw, secretary).

Sheffield.—Houses (200), Shirebrook Avenue estate; E. Cooper, builder, Shirebrook House, Gleadless Town End.

Smethwick.—Houses (62), Spout House estate; Edward Turner. Three schools; E. S. Hoare, consulting engineer. Extensions to Pedigree works; British Pens, Ltd.

Somerset.—Boys' secondary school, Yeovil (£26,321), for County E.C.; W. T. Nicholls, Ltd., builders, Gloucester.

Southend-on-Sea.—Secondary school, Earls Hall estate, for Borough E.C.; F. W. Smith, education architect. Reconstruction of Palace Hotel, electrical work, for Palace Hotel (Southend), Ltd.; Mark Hauser, managing director.

Southgate.—Baths, Winchmore Hill Road (£60,000); borough engineer.

South Petherton.—Isolation hospital, for the South Somerset Joint Hospital Board; Petter Warren & Roydon Cooper, architects, Old Sarum, Yeovil.

Standish-with-Langtree (LANCASHIRE).—Houses (116), Avondale site; U.D.C. surveyor.

Stocksbridge (YORKSHIRE).—Houses (52); L. Platts & Co., 18, Smithy Moor Lane.

Stoke-on-Trent.—Baths, Wharf Street (£81,000); city engineer.

Sunderland.—Station, Fulwell, for L.N.E.R.; J. Miller, architect, L.N.E.R., York.

Surrey.—Girls' secondary school, Nonsuch Park, Cheam, for County E.C.; secretary, Kingston-on-Thames.

Sutton Coldfield.—Senior school, Holland House estate, for E.C.

Swindon.—Houses, Marlborough Road; E. H. Bradley & Sons. Five shops and flats, Victoria Road; R. J. Beswick & Sons.

Tadcaster (YORKSHIRE).—Cinema, Westgate, for M. Hartley & Sons, Ltd.

Taunton.—Extensions to works for Harding, Tilton & Hartley, Ltd., Victoria Street.

Thornton Heath.—Alterations to Savoy Cinema, London Road; W. R. Glen, architect.

Tonbridge.—Showrooms, offices and stores, High Street, for Charles Baker & Co. of Tonbridge, Ltd.

Tottenham.—Alterations and additions to Earlsmead and Parkhurst schools, for E.C.

Urmston.—Houses, Abingdon Road, Davyhulme, Royston Road, Sherborne Road, and Furness Road, Davyhulme; Albert Locke, Ltd., builders, Lostock Road, Davyhulme, Manchester.

Waddon.—Factory and offices, Purley Way; Nevelin Electric Co., Ltd.

Wallasey.—Houses, Gorsedale Road; borough engineer. Central school, Coronation Avenue (£36,665); R. Costain & Sons (Liverpool), Ltd.

Walsall.—Houses (74), Ryecroft estate (£22,000); L. G. Pearce.

Walton-le-Dale.—Council offices, Station Road, Bamber Bridge; A. Threlfall, Ltd., builders, Farington saw mills, Leyland, Lancashire.

Watford.—Library and electricity showrooms; W. W. Newman, borough engineer.

Wednesbury.—Factory for Newmans Tubes, Ltd.

Wolverhampton.—Houses (250), Low Hill estate (£89,371); A. M. Griffiths & Son, Ltd. Houses (80), Oxley Moor Road, &c.; W. Winsper. Cinema, Warstones Road; Penn Cinema Co. Extensions to factory, Birmingham Road; F. W. Male & Sons, Ltd. Extensions to works, Rough Hills; Frost & Sons, Ltd. Extensions to works, Stafford Road, for the Goodyear Tyre Co., Ltd.

Wood Green.—Houses (62), Devonshire Hill Farm estate; Farebrother, Ellis & Co., 29, Fleet Street, London, E.C.4. Extensions to factory, Wellesley Road; W. Stephens & Sons.

Worcester.—Houses (40), Beachpole housing site; city surveyor, Guildhall.

Worsborough.—Houses (152), Yews Lane; T. Shield, U.D.C. surveyor.

York.—Extensions to Theatre Royal; C. J. Minter, city engineer.

Yorkshire.—Infants' school (250 places), Guiseley, for County E.C.